SCIENCE

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MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Prof. J. McKeen Cattell, Garrison-on-Hudson, N. Y.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

THE preliminary announcement of the forty-sixth meeting, to be held at Detroit, from the 9th to the 14th of August, has been prepared by the Permanent Secretary. The arrangements have in large measure been already announced in this JOURNAL, and we hope to print later the provisional programs of the Sections. The approaching meeting has aroused much interest in Detroit and throughout the State. Strong local committees have been appointed and excellent arrangements have been made for the meetings and for the entertainment of members.

The first meeting of the Council will be at noon, on Saturday, August 7th, at the Hotel Cadillac, which will be the headquarters of the Association. The offices of the local committee and of the Association, as well as the halls for the general sessions and rooms for all the Sections, will be in the Central High School of the city of Detroit. This new school building is most admirably adapted for the purpose, and has a large number of halls of a suitable size for the meetings of the Sections; while the Auditorium Hall accommodates over two thousand persons.

On the morning of Monday, August 9th, the first general session will be held at 10 a. m. Owing to the death of Professor Edward D. Cope, the President of the Asso-

ciation, Professor Theodore Gill, of Washington, D. C., as Senior Vice-President, will call the meeting to order and introduce the President-elect, Professor Wolcott Gibbs, of Newport, R. I. Addresses of welcome will be made by Mayor William C. Maybury and Hon. Thomas W. Palmer, and President Gibbs will reply. Announcements by the General, Permanent and Local Secretaries will be made and after adjournment the Sections will be organized.

On the afternoon of Monday, August 9th, the Vice-Presidents of the Sections will make addresses as follows:

At half-past two o'clock. Vice-President Barus, before Section of Physics: 'Long Range Temperature and Pressure Variables in Physics.' Vice-President McGee, before Section of Anthropology: 'The Science of Humanity.' Vice-President White, before Section of Geology and Geography: 'The Pittsburg Coal Bed.'

At half-past three o'clock. Vice-President Beman, before Section of Mathematics and Astronomy: 'A Chapter in the History of Mathematics.' Vice-President Colburn, before Section of Social and Economic Science: 'Improvident Civilization.' Vice-President Howard (nominated by Council to fill vacancy caused by the death of Dr. G. Brown Goode) will give by request of the Council an address before Section of Zoology, subject to be announced.

At half-past four o'clock. Vice-President Mason, before Section of Chemistry: 'Sanitary Chemistry.' Vice-President Atkinson, before Section of Botany: 'Experimental Morphology.' Vice-President Galbraith, before Section of Mechanical Science and Engineering: 'Applied Mechanics.'

On Monday evening Dr. Theodore Gill will give a memorial address on the life and work of the late President of the Association, Professor Edward D. Cope.

The meetings of the Sections will follow on the mornings and afternoons of Tuesday, Wednesday, Thursday and Friday. It is expected that on two days of the week the Geological Society of America and the American Chemical Society will hold meetings occupying the time of Sections E and C.

The usual receptions and excursions have been planned, including a visit to Ste Claire Flats, on Saturday after the adjournment. It is expected that the members of the Association at Detroit will go in a body to Toronto to join in welcoming the members of the British Association to America. For this purpose special rates will probably be secured by steamer and train from Detroit to Toronto.

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*INTERNAL SECRETIONS, CONSIDERED FROM A CHEMICO-PHYSIOLOGICAL STANDPOINT**

In considering this subject from a chemico-physiological standpoint allow me at the outset to emphasize the fact, now well established, that the symptoms which follow the simple removal of a physiologically active gland from the body result wholly from the loss of the gland. You may recall that when attention was first drawn to the possibility of producing the typical symptoms of myxœdema in monkeys by removal of the thyroid gland there was a tendency to assume injury to the sympathetic or other nerves of the neck as an explanation of the phenomena, rather than to admit the possibility even of a general or limited disturbance of the metabolism of the body through chemical changes associated with removal of the gland. It was not until the experiments of Murray made clear the fact that the effects resulting from the removal of the thyroid in man could be overcome, in part at least, by administration of the gland-substance that scientific investigation took the proper turn and a full realization of the possible importance of the so-called ductless glands and their internal secretions began to dawn upon the mind. To-day, however, we recognize their functional activity as a necessary element for the welfare of the body. Their removal, or any impairment of their function, may produce even more disturbance of physiological equilibrium than a corresponding disarrangement of glands formerly consid-

*Read at the Fourth Triennial Congress of American Physicians and Surgeons, May 5, 1897.

ered of greater physiological value. Further, it needs to-day little argument to support the view that such power as these physiologically active glands possess is due to definite chemical compounds elaborated by the glands as products of their individual secretory or metabolic activity. As with other glands having more obvious functions, the secreting cells plainly manufacture certain specific products, but in the case of the internal secretions these products find their way into the blood and lymph, by which they are distributed throughout the body, and thus made available either in controlling or regulating the general nutrition of the economy or to serve some more specific purpose of equal importance for the welfare of the organism. This being so, it is equally probable that in the general and specific metabolism going on in all the tissues and organs of the body the various products formed and absorbed by the blood and lymph may contribute somewhat to the welfare of the body prior to their excretion. In its broadest sense, therefore, internal secretion must be looked upon as something common to all active tissues, the ordinary katabolic products of both circulating and morphotic proteids, for example, no doubt exerting some physiological action during their transit from the place of their formation to the organ which serves for their excretion. It is well, perhaps, to give full recognition to this possibility, for physiological equilibrium in the broadest sense is clearly dependent upon the harmonious action of a large number of related parts, and experiment only can determine, and perhaps then imperfectly, how far the products of one gland or tissue are essential for the well-being of the whole. We know, however, that certain organs with the products they elaborate can be dispensed with, while the removal of other organs involving no greater surgical interference is quickly followed by marked disturbances and later by death. Czerny had no difficulty in removing the stomach from dogs, the health of the animals remaining unimpaired when the œsophagus was properly joined to the intestine. Similarly, Schäfer and Moore* have recently shown that both parotids and both submaxilliary glands may be removed from the dog without any disturbance of nitrogenous metabolism, or without any apparent effect upon carbohydrate digestion. Evidently these glands do not possess any intrinsic internal secretion necessary to the life of the animal or having any important action on the metabolic processes of the body. If they do furnish an internal secretion it obviously must be one common in function to that supplied by some other organ. In the present discussion, therefore, we may advantageously limit the term 'internal secretion' simply to those specific products which, being manufactured in certain definite glands, are plainly endowed with well-defined physiological action.

Let us first consider the thyroid gland upon which more work has been done than upon any other similar structure. Dating from 1883, when Kocher and Reverdin published their well-known observations on the effects of thyroidectomy in the human subject, it has gradually become apparent that there are two distinct ways in which the effects of the operation may be manifested.† Thus, in some animals, as in most carnivora, complete removal of the thyroidal tissue is followed by a rapid development of symptoms indicating a marked irritation of the nervous and muscular systems as manifested by tetanus, epileptiform convulsions, etc., terminating in death. In other cases

*Proceed. Physiol. Soc; Journal of Physiol. Vol. 19, No. 4.

† Compare Roos: Ueber die Einwirkung der Schilddrüse auf den Stoffwechsel nebst Vorversuchen über die Art der wirksamen Substanz in derselben. Zeitschr. f. physiol. Chem. Band 21., p. 19. This paper contains numerous references.

slowly developing changes are observed corresponding to myxœdema. Hence, in some animals thyroidectomy is followed by such a marked disturbance of physiological balance that death results very quickly, while in others the development of symptoms is very slow, giving rise to chronic effects which may endure for months. Evidently, aside from the more acute and toxic effects which may immediately follow the operation, there are more gradual disturbances of metabolism which eventually lead to the complete breaking down of the animal. That the symptoms thus produced are dependent upon the withdrawal from the system of certain specific products is evident from the fact that after extirpation of the thyroidal tissue the mere feeding of thyroid glands, or the subcutaneous and intravenous injection of thyroid extracts, suffices to quickly dispel the myxoedemal swellings, the rough thickened condition of the skin, the muscular and mental apathy, etc.* With dogs the convulsions which follow extirpation of the thyroids are quickly checked by the subcutaneous injection of thyroid extracts. Experiments along these lines with extracts of dead tissue have, as you know, made it very evident that the thyroid gland forms some one or more specific substances, the absence of which from the body sooner or later renders life impossible. Where, however, the animal, as a dog, is provided with accessory thyroids the entire thyroid gland may be removed without death resulting, providing one of the parathyroids is left, but if both parathyroids are excised then 40 per cent. of the thyroidal tissue proper must be left in order to have the dog live.† Evidently, the thyroids and accessory thyroids have more or less of a common function, the one being able to fulfil the purpose of the other to a certain degree; a fact which in itself may be taken as evidence of the importance of thyroidal tissue and the care exercised by nature in preventing its complete suppression.

The very nature of the physiological results which follow the removal or accompany the atrophy of the thyroidal tissue suggests the formation of one or more toxic substances to which the well marked symptoms are due; substances which are either not formed in the presence of thyroidal tissue or else being formed are either neutralized (physiologically) or decomposed and rendered inert by substances furnished by the thyroid gland. Such a view obviously implies a difference in the character and possibly in the extent of the metabolic changes going on in the body, and we may, therefore, advantageously consider the character of our knowledge upon this subject. A careful study of the literature shows quite clearly that certain definite statements are justified. Thus, Leichtenstern and Wendelstadt* found by feeding thyroid glands to healthy obese individuals that a marked loss of body-weight resulted. Roos,† experimenting with normal dogs, observed that in feeding the gland substance for several days there was a marked increase in the excretion of nitrogen through the urine, also of sodium chloride and of phosphoric acid (P_2O_5). On dogs with the thyroids removed, this action was still more marked, so far as the excretion of nitrogen and chlorine was concerned, also in the loss of body-weight and in the excretion of water, but the excretion of phosphorus fell behind the normal. Further, in an ex-

* See Kent: Thyroid extract after Thyroidectomy. Proceed. Physiol. Soc; Journal of Physiol. Vol. 15. Also Meltzer: Ueber Myxödem. Centralbl. f. Physiol. 1894, p. 698.

† Edmunds: Observations on the Thyroid and Parathyroid of the Dog. Journal of Physiol. Vol. 22. Proceed. Physiol. Soc. June 27, 1896.

* Ueber Myxœdem und Entfettungskuren mit Schilddrüsenfütterung. Deutsch. med. Wochenschr. 1894. No. 50.

† Loc. cit.

periment with a goitre-patient, otherwise healthy, Roos observed on feeding thyroid glands a similar tendency towards increased excretion of nitrogen and chlorine with a marked increase in the output of phosphoric acid. Mendel, Napier, Ord and others, making observations on myxoedema patients, likewise noted that the use of thyroid preparations by subcutaneous injection, by glycerin extracts, etc., as a rule, not only led to a betterment of the symptoms, but gave rise to a marked diuresis, loss of body-weight and increased excretion of nitrogen or urea. Denning,* likewise, found that while different individuals reacted somewhat differently under thyroid feeding, yet there was a general tendency toward increased excretion of nitrogen as well as a loss of body-weight. It was also noted that the excretion of nitrogen and urea was not always parallel. Occasionally albumin and sugar appeared in the urine. In one case the volume of urine excreted rose at once 200 cc. per day, the pulse rate increased 22 per cent., while the nitrogen excreted rose 15 per. cent during the feeding period. Similarly, in Basedow's disease, Scholz† observed under the influence of thyroid feeding in a patient 29 years old diuresis, increased excretion of nitrogen and sodium chloride with a marked decrease in the excretion of phosphoric acid. Magnus Levy‡ likewise records that a healthy individual taking thyroid tablets for 19 days lost 7 pounds body-weight with some increase in O_2 and Co_2 exchange. In three cases of Basedow's disease, on the other hand, oxygen consumed and carbonic acid excreted were greatly in excess of the normal. Fritz Voit,* by carefully conducted experiments on healthy dogs, found that the feeding of fresh thyroid glands produced a marked increase in the output of carbonic acid as well as of nitrogen. Michaelson† found after extirpation of the thyroid in hungry cats the Co_2 excretion increased, while J. L. Smith‡ has observed that when thyroidectomy is performed on cats there is a marked disturbance of the heat-regulating mechanism.

From these and other observations that cannot be recorded here it is very plain that the administration of thyroid gland and thyroid extracts to normal individuals, and especially to thyroidectomized animals and individuals in whom the thyroid glands are diseased, produces a very noticeable effect upon the metabolism of the body, leading to a marked loss of body-weight, an increased excretion of water, nitrogen and carbonic acid, and also of sodium chloride. This great diminution of body-weight is by no means due wholly to loss of water nor to removal of fat, for if a healthy individual is fed upon a diet rich in fats and carbohydrates the well-known proteid-sparing power of the latter foods is not able to keep down the loss of nitrogen when thyroids are administered. Proteid material is still broken down in increased quantity, and not from any individuality of the person experimented upon, but plainly under the ex-

*Ueber das Verhalten des Stoffwechsels bei der Schilddrüsentherapie. Münchener med. Wochenschr. 1895. No. 17. Also No. 20.

†Ueber den Einfluss der Schilddrüsenbehandlung auf den Stoffwechsel des Menschen insbesondere bei Morbus Basedowii. Centralbl f. innere Med. Band 16, p. 1041 and p. 1069.

‡Ueber den respiratorischen Gaswechsel unter dem Einfluss der Thyreoidea, sowie unter verschiedenen pathologischen Zuständen. Berliner klin. Wochenschr. 1895, p. 650. See also Richter: Zur Frage des Eiweisszerfalles nach Schilddrüsenfütterung. Centralbl. f. Physiol. Band 10, p. 49. Also Ducceschi: Beitrag zur Erforschung der Stoffwechselvorgänge bei thyroidectomirten Thieren. Ibid. Band 10, p. 217.

*Stoffwechseluntersuchungen am Hund mit frischer Schilddrüse und Jodothyrin. Zeitschr. f. Biol. Band 35, p. 116.

†Jahresbericht f. Thierchemie. Band 19, p. 335.

‡On some effects of Thyroidectomy in animals. Journal of Physiol. vol. 16, p. 378.

citing influence of the thyroid.* The gland substance evidently causes an increased decomposition of the tissue proteids, thus showing a certain resemblance to the action of phosphorus on the organism (Roos). At the same time the loss of body-weight under thyroid feeding is far greater than can be accounted for by the increased proteid decomposition, from which, in conjunction with the increased gaseous exchange, we must infer an increased breaking down of fatty tissue in accord with the prevalent idea that thyroids tend to reduce obesity. This, furthermore, is in harmony with the well-known fact that increase in proteid metabolism is almost invariably associated with increase in the metabolism of non-nitrogenous matter.

The significance to be attached to this increase in proteid metabolism, however, is, I think, something more than a mere quantitative one. The very fact that there are quantitative changes renders it quite probable that there are also qualitative changes, and that the presence or absence of the thyroid gland or its equivalent from the body may modify the *line* of metabolism. Upon this point, however, we know very little; we simply infer. Still there are some facts in connection with the proteids of the blood which are worthy of a moment's consideration. Thus, it has been shown by comparison of the proteids of normal dog's blood with those present in the blood after extirpation of the thyroids that in the period preceding the convulsions the percentage amount of serum-albumin is increased and the globulins decreased. In the second period, on the other hand, when the cramps or convulsions appear up to the end, there is a progressive increase in the amount of globulin and a decrease of serum-albumin as well as of the total proteid. Hence, there is at first an increase and then a decrease of the albumin quotient. From this it would appear that in the first stages there is an abatement of the metabolism of the tissues, followed by an increase, and that possibly in the incomplete breaking-down of the proteid material intermediate toxic products appear which are the cause of the cachexia.* Further, according to Formánek and Haskovec,† in the thyreopriva cachexia, resulting from the extirpation of the thyroids in dogs, the number of red blood corpuscles is systematically diminished, while the leucocytes are increased, and the dry residue of the blood as well as the iron and hæmoglobin are diminished. In connection with the diminution of hæmoglobin there is an acceleration of respiration and of the pulse, which, however, in the terminal stages of the cachexia diminishes. The iron liberated by the decomposition of the red blood corpuscles is deposited in the organs of the body, especially in the spleen and lymph glands. If the blood is taken for examination during a convulsive seizure, on the other hand, it shows a reversal of the above conditions; it is thicker, contains more solid matter, as well as iron and hæmoglobin. If extract of the thyroid is injected into the operated animal there is an immediate increase in the number of red corpuscles and a betterment of the animal's condition. Hence, the thyroid is evidently concerned in hæmatosis, and it is quite possible that the decomposition of the blood which takes place induces certain alterations in the formation of the end-products of metabolism, so that poisons result which give rise to intoxication of the organism. Just here it may be

* Bleibtreu und Wendelstadt. Stoffwechselversuch bei Schilddrüsenfütterung. Deutsche med. Wochenschr. 1895, p. 348.

* Beitrag zur Lehre über die Function der Schilddrüse, Jahresbericht f. Thierchemie, 1895, p. 375.

† Ducceschi: Ueber die Bluteiweissstoffe des Hundes im Verhältniss mit den Folgen der Schilddrüsenexstirpation. Centralbl. f. Physiol. Band 9, p. 359.

mentioned that some recent observations on the feeding of thyroids in insanity tend to show that the percentage of the small mononuclear cells or lymphocytes of the blood are increased while the multinuclear neutrophiles are correspondingly diminished under the action of the drug, thus suggesting that the gland-tissue or its active principle has a direct stimulating influence upon those tissues of the body directly concerned in the production of the lymphocytes, viz, the lymphatic or adenoid tissues.*

In addition to these changes, emphasis must be laid upon the apparent connection between the thyroid gland and phosphoric acid metabolism. Thus, the increased excretion of P_2O_5 after feeding thyroids to normal animals, and the great decrease in the case of animals with the thyroids removed, is naturally suggestive. The facts may be explained in two ways: either the metabolism of phosphoric acid and its excretion are retarded in the absence of the gland, so that there is a retention of P_2O_5 in the body, or else the organism can assimilate sufficient phosphoric acid only in the presence of the substance or substances furnished by the thyroid gland (Roos). It has been suggested, as you know, that the activity of the thyroid gland is a toxic one, but that this action is normally paralyzed by some one or more products of its own metabolism. The view that in the absence of the thyroid gland not enough P_2O_5 can be assimilated for the wants of the body finds a certain degree of confirmation in some of the symptoms noticeable in cretinism and myxœdema; viz, the retardation in bone-development and the slow calcification in cretinism. On the other hand, the tendency toward tetanus might perhaps be explained on the ground of an acute P_2O_5 retention in the central nervous system similar to that of uræmia; or, equally plausible, as due to a marked deficiency of P_2O_5 in this tissue. Thus, in Basedow's disease the observations of Kocher that administration of sodium phosphate leads to a marked betterment of all the symptoms are directly pertinent.

Further, we must not overlook the fact clearly shown by Halliburton,* in connection with Horsley, that after thyroidectomy there is a distinct tendency toward an increase in the percentage of mucus in the tissues of the body, especially marked in the connective tissues and salivary glands. While this increase is not as great as at one time thought, it is still distinctly recognizable and affords additional evidence that the thyroid plays some important part in the katabolic processes of the body, and that when it is removed or diseased the normal chain or rhythm of metabolism is broken. As to the chemical nature of the products which are directly responsible for the results attending thyroidectomy or associated with a morbid condition of the thyroid we have no direct knowledge, and as to their physiological character we can only infer from the nature of the symptoms which result. It is to be presumed that the toxic products are formed not in the thyroid, but in the tissues of the body and as a result of perverted metabolism due to atrophy or alterations of the thyroid gland. The latter evidently furnishes something which either directly neutralizes toxic products common to the body, or far more probably prevents their formation through an influence upon the line of metabolism, or to give due weight to all the views which have been advanced, both suggestions may be correct.

What now is the chemical and physiological character of the protective products which thyroidal tissue evidently manufactures? To this question there are many conflicting answers; still out of the chaotic mass of material available I think it is pos-

*Perry: Some studies of the blood in Thyroid feeding in Insanity. *Medical Record*, August, 1896.

*See Halliburton's Handbook of Chemical Physiol., p. 505.

sible to draw certain definite conclusions. In the first place it must be remembered that the epithelial cells of the thyroid gland apparently manufacture a so-called colloid secretion which evidently finds its way into the blood through the lymph, presumably carrying with it the active principles. This secretion obviously cannot be collected for study, but such active principles as it contains may be sought for in the gland itself, since we have every reason to believe in their ready solubility. By histological methods applied to sections of the thyroid it has been shown that the colloid matter gives the general proteid reactions, that it is very soluble in dilute alkaline fluids and readily dissolved by gastric digestion.* Our knowledge of the chemical composition of the thyroid gland, and hence presumably of the colloid secretion, is due mainly to the work of Bubnow,† Gourlay,‡ Notkin,§ Moscatelli,|| Fränkel,¶ and especially Baumann and Roos,** and Hutchinson.†† To briefly summarize the present state of our knowledge, ignoring minor points of difference, I think it is quite clear that the thyroid gland is especially characterized by the presence of a compound proteid of peculiar constitution, and that this substance which Hutchinson calls 'colloid matter' is the active constituent of the gland. There is also present another proteid, a nucleo-albumin, in small amount, which Hutchinson considers as probably contained in the cells of the acini. In addition there are certain extractives to be found, viz., xanthin, hypoxanthin, inosite,* volatile fatty acids, paralactic acid, succinic acid and calcium oxalate; bodies, however, of no special physiological significance.

The chief interest centers around the above mentioned proteid material, which is plainly of a peculiar kind, since it tends to hold a certain amount of iodine in combination and yields on decomposition a peculiar non-proteid substance carrying with it most, if not all, of the iodine and endowed with marked physiological action. This latter substance, to which Baumann has given the name of thyroiodin, later changed to iodothyrin, is especially characterized, chemically, by its great resistance to ordinary decomposing agents. Digestion of the thyroid gland with active gastric juice yields the iodothyrin as an insoluble residue, but still active. The gland can even be boiled an entire day with ten per cent. sulphuric acid without loss of the active principle, the latter separating from the cooled fluid as a fine flocculent precipitate almost wholly insoluble in cold water and acid, soluble in hot alcohol and readily soluble in dilute alkalies. When purified by repeated precipitation, re-solution, etc., the body may contain as much as ten per cent. of iodine. In the gland, according to Baumann, iodothyrin exists in great part combined with albumin and in smaller amount with globulin, and these compounds are likewise physiologically active,

*Langendorff; Beitrag zur Kenntniss der Schilddrüse. Du Bois-Reymonds Archiv f. Physiol., 1889, Supplementheft, p. 219.

†Beitrag zur d. Untersuchung der chemischen Bestandtheile der Schilddrüse des Menschen und des Rindes. Zeitschr. f. Physiol. Chem., Band 8, p. I.

‡The Proteids of the Thyroid and the Spleen. Journal of Physiol., Vol. 16, p. 23.

§Zur Schilddrüsen-Physiologie. Virchows Archiv. Band 114. Supplementheft, p. 224.

||Beiträge zur Kenntniss der Milchsäure in der Thymus und Thyreoidea. Zeitschr. f. physiol. chem. Band 12, p. 416.

¶Thyreoantitoxin, der physiologisch wirksame Bestandtheile der Thyreoidea. Wiener klin. Wochenschr., 1895, No. 48.

**Ueber das normale Vorkommen des Jods im Thierkörper. Zeitschr. f. physiol. Chem. Band 21, p. 319 and 481. Band 22, p. 1.

††The Chemistry of the Thyroid Gland and the nature of its active constituent. Journal of Physiol. Vol. 20. p. 474.

*Tambach. Pharmaceutische Centralhalle, March, 1896.

although less so than the iodothyrin itself. The iodothyrin of Baumann is thus a non-proteid cleavage product of a more complex body, naturally present in the gland and characterized by containing both iodine and phosphorus (0.5 per cent.). Aqueous and glycerin extracts of the gland contain iodothyrin or the mother-substance, although they do not take up all of the substance. Extraction of the gland with 0.75 per cent. sodium chloride solution, frequently repeated, removes all of the iodine-containing substance, and the residual tissue has little or no effect upon goitre.*

That iodothyrin possesses all the peculiarities associated with thyroid-therapy is, I think, pretty thoroughly established. The experiments of Roos† upon animals, and the clinical observations of Leichtenstern and Ewald, have clearly demonstrated the physiological power of the substance. Its action on goitre,‡ as tested in over a hundred cases, is very noticeable. In the parenchymatous form a few day's treatment suffices to greatly reduce the size of the swelling. Normal dogs in nitrogenous equilibrium, treated with iodothyrin, suffer a marked loss of body-weight, an increased excretion of nitrogen, NaCl and P_2O_5, while diuresis is equally marked (Roos). Further, comparative experiments by Fritz Voit,§ most carefully conducted on dogs in nitrogenous equilibrium, with fresh thyroid and iodothyrin show that the latter has practically the same action as the former in increasing the decomposition of fat and in stimulating the metabolism of proteid matter. In myxœdema the physiological action of iodothyrin is equally pronounced. Thus, in one case,* a 16-year-old patient received for 6 days 2 grams of iodothyrin (= 0.6 milligram iodine) daily. In the fore-period of 3 days she received 18.02 grams of nitrogen and excreted 17.88 grams. In the iodothyrin period she ingested 16.2 grams of nitrogen and excreted 20.0 grams, while in the 3 days after-period she consumed 15.65 grams of nitrogen and ingested 21.59 grams. In 10 days the body-weight fell 4 pounds. In the treatment of obesity iodothyrin has likewise been effective.†* It has also been clearly established by experiments on dogs that iodothyrin will cut short the various symptoms produced by thyroidectomy, noticeably the convulsions.‡ As Baumann and Goldmann§ have shown, dogs with thyroids removed do not manifest symptoms of tetanic convulsions so long as iodothyrin is given regularly each day in doses ranging from 2 to 6 grams. Further, in such cases the withdrawal of the iodothyrin, or a marked reduction in the amount administered, is generally followed by an appearance of the convulsions. The dosage required to remove or overcome the tetanus of a dog suffering from thyroidectomy is greater the more vigorous the symptoms and the longer the administration has been delayed after the appearance of symptoms.

* Roos: Zur Frage nach der Anzahl der Wirksamen Substanzen in der Schilddrüse. Münchener med. Wochenschr., 1896, p. 1157.

† Ueber die Wirkung des Thyrojodins. Zeitschr. f. physiol. Chem. Band 22, p. 18.

‡ See Ewald und Bruns: Verhandlungen des Congresses für innere Medicin, 1896, p. 101.

§ Stoffwechseluntersuchungen am Hund mit frischer Schilddrüse und Jodothyrin. Zeitschr. f. Biol. Band 35, p. 116.

* Treupel: Stoffwechseluntersuchung bei einem mit Jodothyrin (Thyrojodin) behandelten Falle von Myxoedem und Mittheilung einiger Thierversuche mit Jodothyrin (Thyrojodin). Münchener med. Wochenschr., XLIII. 38, p. 885. See also Notkin, Virchows Archiv. Band 144, Supplementheft.

† See Grawitz: Beitrag zur Wirkung des Thyrojodin auf den Stoffwechsel bei Fettsucht. Münchener med. Wochenschr., 1896, No. 14. Also Henning Ibid., 1896, No 19.

‡ Hoffmeister: Deutsch. med. Wochenschr., 1896, No. 22. Hildebrandt; Berliner Klin. Wochenschr. 1896, No. 37.

§ Ist das Jodothyrin (Thyrojodin) der lebenswichtige Bestandtheil der Schilddrüse? Münchener med. Wochenschr., 1896, p. 1153.

The negative results obtained by Gottlieb* have been recently shown to be due to the employment of a poor preparation.

Does the physiological action of the thyroid gland reside wholly in this so-called iodothyrin or its antecedent? In attempting to answer this question we must give a moment's attention to Fränkel's so-called thyreoantitoxin.† This, as you may remember, is a crystalline body of neutral reaction obtained from the proteid-free extracts of the thyroid gland. It is soluble in water and alcohol, but precipitable by ether and acetone, and from its composition it has been suggested that it is a guanidin derivative. Fränkel ascribed to this substance the physiological activity of the thyroid gland, since he obtained a suspension of convulsions with thyroidectomized cats on injecting this body. Further, Drechsel‡ has made a preliminary communication to the effect that the proteid-free extract of the thyroid from pigs contains two crystalline substances in small amount, which when fed to thyroidectomized animals appear somewhat active, although not strongly so. Drechsel therefore suggests that possibly there may be three active substances present in the thyroid, viz, two bases, one identical with Fränkel's antitoxin, and Baumann's iodothyrin. He would thus ascribe to the thyroid several associated functions and corresponding to each a distinct chemical substance. Theoretically, of course, this is quite plausible, but Drechsel's compounds have not been further heard from and there are many recent observers who fail to find any physiological action whatever with the proteid-free extract from the gland.§ Moreover, careful comparative study of the action of thyreoantitoxin and iodothyrin in a myxoedema patient showed that while the former was entirely without beneficial action the latter produced all the results characteristic of thyroid feeding.* Further, Roos,† by experiment on a normal dog in nitrogenous equilibrium, found that thyreoantitoxin was wholly without influence on metabolism, while iodothyrin given to the same animal under like conditions caused at once a marked increase in the output of nitrogen, NaCl and P_2O_5. In other words, thyreoantitoxin shows with certainty none of the properties of the thyroid gland, while iodothyrin is apparently the physiological equivalent of the gland. Indeed, in its action on goitre iodothyrin is more effective than the gland itself, since when the gland is taken it must first undergo digestion to liberate the iodothyrin and some may be lost by putrefactive changes in the intestine.

What now is the significance of the iodine contained in the so-called iodothyrin? Iodine is not a common constituent of the animal body, and its discovery by Baumann in the thyroid gland toward the end of 1895 was the first intimation of its presence in the human organism. So far as known, it is not normally present to any extent in other tissues.‡ Traces, however, are found in the thymus of the calf (Baumann).§ Barrell has likewise reported the presence of traces in the spleen, adrenals and the ovaries of pigs and cows. The amount, however, is very small as compared with that found in the thyroid. Calling the amount of iodine in 1 gram of fresh thyroid as 1, the spleen contains $\frac{1}{20}$, the adrenals $\frac{1}{130}$, and the ovaries

* Deutsch. med. Wochenschr., 1896, No. 15.

† Wiener klin. Wochenschr., 1895, No. 48.

‡ Die Wirksame Substanz der Schilddrüse, Vorläufige Notiz. Centralbl f. Physiol. Band 9, p. 705.

§ See Hutchinson: The chemistry of the Thyroid Gland and the nature of its active constituent. Journal of Physiol., Vol. 20, p. 491.

* Magnus Levy: Deutsche med. Wochenschr., 1896, No. 31.

† Münchener med. Wochenschr. 1896. No. 47.

‡ Drechsel has reported finding a distinct trace of iodine in the hair of a syphilitic patient treated for a long time with postasium iodide. Centralbl. f. Physiol. Band 9, p. 704.

§ Vorkommen von Jod in den Ovarien. Chemisches Centralblatt, 1897. Band 1, p. 608.

$\frac{1}{61}$–$\frac{1}{65}$ per gram of fresh tissue. Iodine has likewise been detected in the human hypophesis.*

In human thyroids, on the other hand, as well as in the thyroids of sheep, oxen and pigs, iodine is most generally present in quite appreciable amount, and pure iodothyrin may contain as much as 10 per cent. of the element. In iodothyrin the iodine is in close combination with the rest of the molecule and is not easily split off even by the action of alkalies. It is noticeable that the thyroids of sheep (and of other animals) vary greatly in their content of iodine. Thus in sheep coming from Freiburg 1 gram of dry thyroid gland contained on an average 0.9–1.3 milligrams of iodine, while the thyroids from Paris sheep contained 1.15–1.2 milligrams of iodine per gram of dry gland, and those from Elberfeld 1.5–5. milligrams per gram of dry tissue. As judged by the rate and intensity of physiological action 0.25–0.3 milligram of iodine in the form of iodothyrin is equal to 1 gram of fresh thyroid gland. Further, according to Baumann, doses of 1 milligram of iodothyrin which contain only $\frac{1}{10}$ milligam of iodine will produce a decided effect upon goitre after 3–4 applications, thus clearly indicating that it is not the iodine *per se* that is effective, but rather the iodine compound.

The content of iodine in human thyroids is likewise variable, the determining factor being apparently the locality in which the individual lived. Thus, in 26 adults dying from various causes in Freiburg the average amount of iodine in the thyroid was 0.33 milligram per gram of dry tissue, while in Hamburg the average from 30 adults was 0.83 milligram per gram of dry tissue. In Berlin, average of 11 adults, 1 gram of dry thyroid contained 0.9 milligram of iodine. It should be noted, however, that in the Freiburg cases the average weight of the gland was 8.2 grams with a total content of 2.5 milligrams of iodine. In Berlin, on the other hand, the average weight of the dry gland was 7.4 grams with a total content of 6.6 milligrams of iodine per gland, and in Hamburg the dried gland weighed only 4.6 grams, with 3.83 milligrams of iodine.

Recently Weiss* has reported the results from fifty analyses of thyroids of adults and children in Silesia, the average weight of the dried gland being 7.2 grams and with an average content of 4.04 milligrams of iodine.

From a large number of observations among children and adults in different localities in Germany, Baumann concludes that in Freiburg, where goitre is endemic, the weight of the thyroid is the largest and its content of iodine the lowest, while in Hamburg and Berlin, where goitre is not endemic, the reverse holds good. As a rule, in cases of goitre only minimal and almost always relatively small amounts of iodine are to be found, from which Baumann draws the conclusion that between the iodine-content of the thyroid and the occurrence of goitre there is a certain definite relationship.

I understand, however, that additional results, not yet published, tend to show that in some cases of goitre the content of iodine is far beyond the normal, thus implying the existence of two abnormal conditions: one in which the iodine-content is below, and another in which it is far above the normal. In old age the content of iodine frequently falls to a minimum, apparently in harmony with the degeneration of the gland. The largest amount of iodine is found between the ages of twenty-five

*Schnitzler und K. Ewald; Ueber das Vorkommen des Thyrojodins im menschlichen Körper. Wiener klin. Wochenschr., 1896, p. 657.

*Ueber den Jodgehalt von Schilddrüsen in Schlesien Chemisches Central-Blatt, 1897. Band 1, p. 298.

and fifty-five.* Many circumstances, however, combine to modify the content of iodine in the thyroids, especially the proximity to the sea-shore with the greater abundance of sea food, etc., and this fact, coupled with the well-known circumstance that in the thyroids of some children iodine is wholly wanting (Baumann), and this without any apparent effect upon the activity of the gland, renders one somewhat skeptical as to the real virtue of the iodine. Blum,† however, states that artificial compounds of iodine, with various forms of proteid matter, exert a beneficial influence upon parenchymatous goitre as well as upon the tetanus and myxoedema induced in dogs by thyroidectomy. The iodine in iodothyrin is certainly not active as iodine; the amount is too small, and it may, perhaps, be questioned if the amount of iodine in the thyroid gland can be taken as a measure of the amount of active substance present. In this connection it may be mentioned that animals with the thyroids removed have no power of retaining the iodothyrin administered by mouth or subcutaneously, the iodine compound appearing in the urine either unaltered or in some modified form (organic).‡

To summarize, the thyroid gland manufactures *one* specific substance of marked physiological power—the so-called colloid of Hutchinson—a body which, though containing phosphorus, is not a nucleo-proteid; neither is it allied to mucin. It is peculiar in that it contains iodine. This body when acted upon by gastric juice or by boiling acids is split into a proteid and a non-proteid part, the latter containing all of the phosphorus and the larger proportion of the iodine of the original colloid. According to Hutchinson both parts of the colloid are physiologically active, but the non-proteid part, the iodothyrin of Baumann, is unquestionably far more active than the proteid part of the original molecule. This substance is apparently the physiological equivalent of the thyroid gland. Lastly, our history would be incomplete without some reference to the theories of Notkin.* This reference, however, may be a brief one, since the theories though ingenious are now known to rest upon a false foundation and have no present value.

Concerning the other internal secretions of the body I have little to say, partly owing to lack of time and partly because there is very little definite chemico-physiological knowledge at our disposal. Our knowledge has not as yet advanced sufficiently to admit of making dogmatic statements regarding the exact chemical nature of the active principles present in the adrenals, testacles, ovaries, pancreas, pituitary body, etc., or of the exact action of extracts of these glands upon the metabolic phenomena of the body. Allow me to say, however, in reference to the adrenals that there is some evidence of the existence of two distinct physiologically active substances, one insoluble in 90 per cent. alcohol, possibly the sphygmogenin of Fränkel, which increases blood-pressure while the other, which is readily soluble in alcohol, causes paralysis of the heart and muscles and death by suffocation.† In this connection it will be

* See Baumann: Ueber das Thyrojodin. Münchener med. Wochenschr., 1896, No. 14.

† Ueber Halogeneiweissderivate und ihr physiologisches Verhalten. Münchener med. Wochenschr., 49, 1099.

‡ Baumann und Goldmann, Loc. cit. See also H. und M. Frenkel. Jod im Harn nach Einnahme von Thyreodintabletten. Berliner klin. Wochenschr., xxxiii, 37, p. 827.

* Zur Schilddrüsen-Physiologie. Virchows Archiv, Band 144. Supplementheft, p. 224. This paper contains a very full bibliography. Notkin's theories are well combated by Hutchinson, Journal of Physiol., Vol. 20, p. 490.

† See S. Fränkel: Beiträge zur Physiologie und physiologischen Chemie der Nebenniere. Centralbl. f. Physiol. Band 10, p. 486. Du Bois: Note prélimi-

remembered that Oliver and Schäfer* have shown that the active principle (or principles) is non-volatile and that its activity is not destroyed by mineral acids or gastric digestion, while alkalies gradually diminish it. According to Marino-Zuco,† the toxic action is due to the presence of neurin glycerophosphate. There are also some grounds for believing a brenzcatechin-like body to be present,‡ which may exert some physiological action. Lastly, in extracts of the testis a peculiar nitrogenous body has been detected, free from oxygen, known as spermin and which is claimed by Poehl § to have a marked influence upon metabolism and to act as a true physiological stimulus. Further discussion of these points at the present time, however, would have little value.

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A CASE OF PRIMITIVE SURGERY.

DURING the first period of my residence among Zuñi Indians, in the autumn of 1890, I was called in to assist two medicine men or priests in the performance of a peculiarly interesting surgical operation.

A man belonging to the clan into which I had been adopted had for several months been suffering from the effects of either a contusion or a strain of the right foot, caused by a throw from his horse. This had at first given little trouble, then had appeared as an ordinary stone-bruise on the right side of the foot just below the instep. The inflammation had, however, extended until the whole foot and the lower part of the leg had become excessively swollen, so much so as to cause the skin to glisten from stretching, save at a point over and around the original injury, at which point a malignant and putrid sore had developed, the odor of which was extremely offensive, and both the foot and the leg were now of livid, purplish-red hue in places, suggestive of actual decay. As a layman in medicine I should have said that the case was now one of advanced mortification, and from the general condition of the patient I should have inferred that blood poisoning was likely soon to ensue.

I gathered from the conversation of the two old surgeons who had been called in, and who had in return requested my attendance in order that I might give 'ease medicine' and 'add with (my) breath strength and endurance to (my) clan-brother,' that it was these appearances, this apparently '*decaying* condition' of the man's extremity, that had determined them to perform the operation.

When I entered the room the patient was lying on the floor and, although in extreme agony, turned his face toward me expectantly and with a smile, uttering the customary words of welcome. His head was pillowed in the lap of his little old white-haired mother, who was gently stroking his forehead and talking to him in the endearing phrases of mothers to little children. At his side was a small bowl containing a clear but bright red liquid (made, I afterwards learned, from an infusion of willow-root bark) in which half floated, half stood, a cane sucking-tube about six inches long. The old surgeons were removing certain

naire sur l'action des extraits de capsules surrénales. C. R. Soc. de Biol., 1896, p. 14.

* The physiological effects of extracts of the suprarenal capsules. Journal of Physiol., Vol. 18, p. 370. See also B. Moore: On the Chemical Nature of the physiologically active substance occurring in the suprarenal gland. Ibid., Vol. 17. Proc. Physiol. Soc., March, 1895.

† Archiv. d. Biol. Ital., Tome 10, p. 325.

‡ Brunner: Chem. Centralblatt., 1892, I., p. 758. Mühlmann: Deutsche Med. Wochenschr., 1896, No. 26.

§ Compt. rendu. Tome 115, p. 129. Zeitschr. f. Klin. Med. Band 26, p. 133. Centralbl. f. d. Med. Wissensch., 1892, p. 950. See also Bubis: Sperminum Poehl in chemischer, physiologischer und therapeutischer Beziehung. Ibid., 1894, p. 703.

bandages from the foot and washing off a yellow powder made from pollen and a certain bitter root, with which the sore had been dressed. They bade me sit at the right side of the man, so as to lay my hands on his left breast and to occasionally breathe into his face and administer to him my 'white medicine' (which contained an opiate).

Then they produced, from a buckskin pouch and a roll of rags, a much shattered bottom of a dark-colored glass bottle and two or three broken nodules of obsidian, also several neat splints of cedar and masses of freshly gathered, clean yellow piñon gum, as well as a carefully tied bundle of willow-root bark and some of the yellow roots and pollen I have before mentioned. With a blunt-pointed knife, used vertically, one of them detached, by tapping, a number of small, thin, sharp flakes or chips from the bottle-glass and obsidian. Six or eight of these diminutive flakes were now selected and mounted, each in the cleft end of one of the cedar splints; some so as to form straight lancets, but others at right angles to the splint handles. The blades of one or two of these latter were wrapped round and round with sinew near the point of insertion in the splint, so that only a limited portion of the edge or tip of each protruded. These and the other improvised surgical instruments were laid out in due order on the floor. A quantity of shredded cedar-bark, buckskin scrapings, and old, soft rags were provided; also a large bowl of fresh water, and another filled with the red liquid and containing a small gourd dipper.

Everything being in readiness, the two priests closed their hands over their mouths and breathed into them, as does a man on a cold day, uttering, meanwhile, short invocations, for strength of wind or breath for the patient, and for power of wind or breath of guidance for themselves; literally the supplication was: "Their [The Being's] wind of life, by its power may his will be strengthened and he quieted be, and likewise by it may our methods and good fortune straight be made!" Bidding the man 'Stay himself with endurance,' since 'Things must be as they must, poor child,' and telling me also to 'Stay him,' with my 'Breath of relationship and sympathy,' they set to work without further delay.

First, they bathed his foot to clear it of the astringent yellow powder, and to cleanse the sore in order that they might be the better able to inspect it. Then, very deliberately, they diagnosed the case, frequently comparing notes. It was from this diagnosis that I learned their reasons for attempting the operation. They believed that the flesh of certain muscles in the foot had died or were dying from the violence done them, and were therefore 'wi-wi-yo-a' (worm-becoming, worm-turning) in the depths of the foot. According to this theory, their plan was to make a double, or inverted T-shape, incision so that the integument could be lifted up from the affected parts in two flaps, the 'dead flesh' removed, the 'decayed' or 'black blood' fully extracted, the worms and the 'seed of their kind' found and utterly uprooted. They thereupon mapped out with their fingers the lines of the incisions they proposed to make. One of them gently bade their patient anew to 'Stay himself,' while the other seized his foot with both hands and turned it up, stretching the skin by pressure; then the first grasped one of the obsidian lancets (mounted sidewise and wrapped with sinew so that the point protruded just sufficiently to sever the skin) and deliberately, but with deft and even stroke, slashed down from the ankle about two and a-half inches, along a line corresponding in direction with that of the tendon of the little toe. He then quickly made another slash from the instep straight down to the middle of the first cut. Catching up one of the

other kind of lancets, he deepened both incisions, avoiding with the utmost skill the crooked vein that descended over this portion of the foot, and also the tendon lying over the tarsal and metatarsal bones. The wound was then squeezed strongly by the assistant, while, with water poured over it and with wads of the cedar bark used as sponges, he washed away the pus and serum that gushed forth, and then with the scraped buckskin stanched the flow of blood.

Having at the outset tenderly admonished their patient, these men seemed thereafter to be oblivious of his agony, to hold in view only his ultimate betterment. And the patient himself seemed almost as oblivious of them, although from suffering his face was drawn and ashen in color, and great drops of perspiration stood on his forehead while his breath came in short quick gasps. Yet he no more changed his grimly set but acquiescent expression than would one of the totem-animals of his ancestry, whose stoicism—as under all circumstances his kind ever do—he sought to emulate. The old surgeons took up one after another of the straight lancets, and with them dissected away the proud flesh and other diseased tissue, removing it cleanly, without severing vein or artery or tendon, until they had fairly exposed the bone itself. Here they found a swollen and diseased bit of nerve or tendon. They ruthlessly cut it out and examined it critically; stuffing some cedar-bark into the wound, they laid their lancets down and discussed thoroughly, and in an interested, leisurely manner, the question as to whether it was already a worm or only a 'becoming' worm. After deciding that whether worm or 'becoming-worm' it was not the chief or sole source of the disease, they laid it carefully aside on some ashes in a hollow potsherd. Then removing the bark and calling upon me to squeeze water into the wound they proceeded until the bone was plainly exposed. They found the periosteum inflamed and discolored, and, therefore, with evident satisfaction, they proceeded to scrape it until every particle of the discoloration was removed. It was claimed that in the substance of the material thus scraped away the deepest source of the disease and 'seat worms' was found. This was also placed on the ashes with the fragment of nerve or tendon. Then one of them took a small fetish, or medicine-stone, from his wallet. It was an ovoid object of banded aragonite, much resembling a ringed worm or maggot. He laid it in the wound. He presently took it out, lifted it aloft with an air of triumph, and carefully placed it on the ashes with the ligament and bone-scrapings. The incision was now held open and thoroughly washed out, and then the chief operator, dipping up gourdfuls of the red liquid, filled his mouth therewith, and repeatedly sprayed the wound by vigorously blowing the fluid into it. All dissected surfaces were then washed, dried with the scraped buckskin, washed and dried again, until it not only became, but actually looked, clean, and was sprayed yet again with the red fluid. Finally, the openings were filled up, or rather stuffed, with the piñon-gum softened by warmth of the breath and in the hands, that were the while kept constantly wet with the red fluid. More of this gum was spread on narrow strips of cloth, and with these the wound was neatly closed as with adhesive plaster. The entire foot was sprinkled or thickly dusted over with the yellow pollen and root-powder, and then bandaged with long strips of the old rags as neatly as it would have been bandaged by a surgeon among ourselves.

The procedure of these primitive surgeons, if we consider the antiseptic treatment involved in their copious sprayings with the willow-bark infusion, in the filling of the wound with purifying piñon

gum and the remarkably effective closure of the incisions thereby, and in the surface-coating with the astringent yellow powder, would certainly seem to have been, almost from beginning to end, as strictly rational also as would have been those of one of our own surgeons. But in reality they were nothing of the sort. If we except the exceeding ingenuity and courage and the anatomic knowledge and skill displayed by these surgeons in their operations, the theories upon which they based their procedure were, from our point of view, irrational in the highest degree. They were a combination of empiric and thaumaturgic modes, chiefly the latter.

These men believed, according to the general philosophy of their people, founded on the superficial appearance of things, that blood—good, fresh, red blood—was the source of 'new flesh.' They believed that when the blood became thinned and black it was weakened and spoiled and must therefore be removed and replaced with fresh blood; that as blood is the source of new flesh, so is water the first source of new blood, of life itself, since nothing can live without water, howsoever abundant sustenance of other sort may be. Therefore, since the willow never lives apart from springs or other continuous sources of water, it must contain within its roots, its sources, the very essence, the very source of life. An infusion of its roots and bark becomes brightly red. It is imagined, therefore, to be the source of new life-blood, of flesh-forming blood itself, and to be effective for the renewal of decaying or 'worm-turning' flesh. The employment of the 'fire-feeding' and, therefore, 'purifying and maturing' piñon gum, and of the cooling and hardening yellow (or 'winter' root) powder and sustaining pollen, also quite, accorded to like ways of reasoning, was as strictly sustained by practical results, and therefore seemed, in turn, to prove the propriety of such reasoning.

They also believed that the violence of the man's injury had so weakened the part injured that it was infested with worms or else was killed and turning to worms. This belief was also based on appearances. Dead flesh putrifies, is filled with pus, or with thin, fluid, black or dead blood, stinks, and is always likely to be, with these people infested with worms (maggots). A festering sore arising from violence, real or imaginary, done to the part in which it occurs exhibits all these characteristics, and, if unchecked, leads to death. Such a sore, if malignant and deep, causes pain as of the bones. Its seed, then, must be deep-seated or in the bones themselves; this seed must be removed, else it will grow and cause death. Any pain like that arising from such a sore, though no sore be apparent, must be caused also by unseen worms or some worm born of violent injury, as by a magical or ghostly arrow.

There remain to be explained two or three of the manifestly irrational operations involved in the procedure. One was the treatment of the pain-causing worm-filament—or diseased nerve—and the ultimate 'source of worm-turning' in the bone they scraped; the other was the use of the maggot-fetish or medicine-stone. The supposedly incipient maggot and the infectious seed-substance of his kind in the bone were placed on the ashes, because fire-ashes are considered, in themselves, to be dissolving and destructive, and (among other quaint reasons) tend toward 'clogging' or 'hindering escape;' for no worm or insect can progress through, or escape from, fine ashes. With the scraping of the bone everything had been done that was humanly possible to remove the infection; but something more must be done, some potency applied, to absorb any remaining infection.

Therefore the fetish-stone, as a sort of spiritual sponge, was introduced.

And I would here enter a plea for the primitive medicine man. He is not usually the arrant knave or juggler so frequently pictured by travellers. His so-called 'tricks' are not attempts at deception. They are solemn operations by which he is himself as much deceived as are any of his witnesses. We are told that these earliest practitioners suck, knead or cut their patients, and end by pretending to find and extract, and by triumphantly holding aloft, some grub, insect or other small object—frequently a minute fetish-stone like the one I have described, that 'they claim' to have actually extracted from the diseased part. We aliens are the only ones of their witnesses who are deceived by them in the way we accuse them of deceiving, for what they really attempt to do is either to expose, or otherwise make as uncomfortable as possible, the animate seat of the disease, and then to furnish it with a decoy, as it were, a vehicle or body of escape, as a killed and squeezed-out body of one of its own kind, or else in the form of its kind as seen in some ancient and more potent and nearly natural object resembling it. Sometimes, again, living insects or worms, or fetishes that are supposed to be living, ravenous and inimical to the worms of disease, are introduced, that they may prey upon and destroy these worms and the seed-substance of their kind. This is especially apt to be the case when thick pus is abundant and parasites are forming; for the squeezed-out pus itself resembles worms more or less, portions of it even in mass, being streaked, seeming to contain their forms in embryo. It, also, is therefore held to be the seed-plasm or substance of worms, and the proof of this is alleged to lie in the fact that, if exposed, like dead flesh, it speedily turns to worms.

The subsequent treatment received by the man whose case I have described, at the hands of his primitive doctors, was quite as much in keeping with this sort of philosophy as had been their operation. His wound was, of course, dressed, cleaned, copiously sprayed, and, I may add, 'Spiritually disinfected,' every day. But, in addition to this, he was put on diet—the freshest or 'newest' possible corn food—and was, for the first four days, deprived of salt (this, too, being abundant in pus-like excreta) and all flesh-food, and was thereafter until perfectly cured—for he recovered with amazing rapidity—denied all meat containg fat and other non-muscular tissue, since these, as well as old and so-to-say 'decrepit' seeds, are supposed to be, of themselves, peculiarly liable to 'worm-turning.'

FRANK HAMILTON CUSHING.
PHILADELPHIA, March 15, 1897.

THE INFLUENCE OF ENVIRONMENT UPON THE BIOLOGICAL PROCESSES OF THE VARIOUS MEMBERS OF THE COLON GROUP OF BACILLI: AN EXPERIMENTAL STUDY.

THE results found in the following pages have been made possible by a grant from the Bache fund of the Smithsonian Institution. The disposal of the grant mentioned is left to the discretion of Dr. John S. Billings and Dr. S. Weir Mitchell. The topic of this research was submitted to these gentlemen at the beginning of the year, and from time to time they have been kept informed of the progress of the work. It is with their approval that this paper is presented for publication. The research of the past year has been a continuation of the studies begun in the fall of 1895, upon the variability of bacteria.

The colon group of bacteria have been chosen for this study, and particular attention has been paid to those forms which appear to be modifications of the typical colon

bacillus which have undergone functional derangement as a consequence of their environment. A short résumé of our experimental work is given in this paper, but we fear that it is insufficient in regard to the details of experiments and the results obtained to maintain our conclusions.

From the observations and deductions of several competent investigators, the pathogenesis of the colon bacillus is due to cultivation in the living fluids of the animal body, which are supplied with an unusual amount of proteid substance by the process of inflammation. We have made experiments with the members of the colon group to ascertain to what extent the proteolytic activity can be increased by growth upon an artificial medium containing large amounts of proteid material. The medium used for our experiment was a bouillon free from sugar and containing a large per cent. of fresh peptones derived from beef muscle by the action of trypsin. These peptones, according to Péré, are capable of forming more indol than those produced by the action of pepsin or any other enzyme.

Series of cultures comprising, severally, the typical colon bacillus, transitional forms of the colon group, and the typical typhoid bacillus, have been carried through a series of cultures in this medium, each culture being changed to fresh media every seventy-two hours, and the old culture tested for indol for the purpose of obtaining an approximate estimation of the proteid digestion.

The result of these experiments was that under these conditions the proteolytic function is increased in activity, so that cultures of the typical colon bacillus gave, in the second generation, after growth for three days in 25 c. cm. of the medium, an indol reaction of a blood-red color in some instances, and requiring in every culture from 10 to 15 c. cm. of a 0.1 per cent. indol solution to give the same depth of color to 25 c. cm. of the sterile medium. Transitional forms of the colon group which have hitherto been supposed to be devoid of the indol-producing power, after cultivation for three or four generations in this medium gave a marked indol reaction. Seventeen different specimens of the typhoid bacillus, obtained by us from some of the best known laboratories in this country, gave also a marked indol reaction after passing through a series of changes in this medium.

Result of excess of one function. The result of the excessive discharge of one function, viz., proteolysis, which has been produced by growth in the fresh peptone bouillon free from sugar, is, first, an increase of the proteolytic activity as shown by the increased amount of indol produced in typical colon cultures, and the production of indol by organisms supposed to be devoid of this property: viz., atypical forms of the colon bacillus, and the typical typhoid bacillus; secondly, after the maximum of indol production is reached, a decrease in proteolytic activity occurs, shown by the lessened amount of indol, and, finally, after several generations, the attenuation and premature death of the organism takes place.

Indol production as an index of pathogenesis. An experiment relating to this question has been carried on for over a year with a virulent culture of the colon bacillus. The culture was tested for indol and virulence as soon as it was isolated. The indol reaction was very marked, and 0.5 c. cm. of a bouillon culture proved invariably fatal to guinea pigs of 500 grammes weight. It was then kept for five months on agar-agar with but few changes, when it was again tested. A faint indol reaction was obtained, and 1 to 2 c. cm. of a bouillon culture was required to kill an animal of 300 to 500 grammes weight. This culture was then placed in the alkali-peptone solution and changed to fresh medium twice in seven days, when tests were again made. The color of the indol reaction was very intense, and 0.3 c. cm. of an

alkali-peptone bouillon culture about twenty-four hours old killed animals weighing from 200 to 300 grammes. This experiment was repeated with the same result, viz., the indol production and pathogenesis were both increased by growth in a medium containing an unusual amount of proteid material so prepared as to be especially suitable for bacterial assimilation. The amount of indol produced by this culture was not greater, however, than is found in other cultures of the colon bacillus which are non-pathogenic. The estimation of the virulence of this organism by the amount of indol formed seems for this reason impracticable.

Cultures from typhoid spleens. We have found by our experiments that the colon bacillus grown in an excess of proteid material in an artifical medium undergoes a disturbance of equilibrium in function, with first an increase of proteolytic activity and later an apparent suppression. Cultures obtained from the pathological tissues of man and animals also present characteristics differing from those of the typical colon bacillus obtained from the healthy colon. For the purpose of demonstrating this modifying effect upon cultures of bacteria belonging to the group under discussion, we have obtained cultures from organs that have been undergoing inflammation for a considerable period of time, viz., typhoid spleens, and have noted their reactions both upon carbohydrate and proteid foods. We have tried to classify these cultures according to these reactions, and with the following results: Cultures corresponding to the typical colon bacillus in reaction have not been found among the cultures studied. A group of cultures were obtained which gave one or more of the prominent reactions of the colon bacillus, and appeared to belong to the transitional series of the colon group. A second group gave the characteristic modifications in function that are found in attenuated cultures of the colon group. A third and larger group gave the reactions of the typhoid bacillus. May not the cultures of the first and second group be colon cultures which have been modified in function by growth in an excess of proteid food?

Our final test for the differentiation of our cultures obtained from typhoid spleens is the serum test, to which the investigations of Widal have recently drawn so much attention that it has become a well-known and popular diagnostic procedure in typhoid fever. We have reversed this test, and have used a specimen of blood which was obtained from a genuine case of typhoid fever, and which had given a characteristic reaction with the typhoid culture used by us for the diagnosis of typhoid fever by the so-called method of Widal for testing our cultures.

The result of this test showed that only about one-third of our typhoid cultures gave what is regarded by us as a positive reaction, although every culture except one showed a distinct agglutination of the bacilli and some degree of cessation of motility. A comparison of the reactions given by the typhoid cultures with those of our cultures from typhoid spleens shows that of 28 cultures derived from typhoid spleens, and giving all the cultural reactions of typhoid bacilli, 18 gave a positive reaction, while 10 did not fulfill the requirements of this reaction in regard to cessation of motion. Two cultures classified as transitional colon cultures gave as typical a reaction as any of the cultures tested.

Our tests upon the series of typical and atypical colon bacilli show that in one culture of each series a reaction was obtained which seemed as striking as any reaction obtained by us with typhoid cultures. Several of the other cultures differed from the control drop by presenting indications of a reaction.

CONCLUSIONS.

Assuming the typical colon bacillus and

the typical typhoid bacillus to represent the types of this group that present the greatest divergences in biological peculiarities, we conclude, as others also have done, that there is a series of closely related forms that may be regarded as intermediate or transitional, and which serve to establish a biological relationship, either near or remote, between these two typical members.

From our own studies we are inclined to regard the typical colon bacillus as the type of this group, for the reason that its functional equilibrium, as observed in the intestine, is so permanent a quality that it may readily be perpetuated under what is ordinarily regarded as favorable artificial circumstances, and that with the continuance of such conditions there is no conspicuous tendency on the part of this organism to deviate from what we regard as its norm; whereas, on the other hand, with all the other members of the group with which we have worked there is not only a lack of uniformity in the adjustment of the functions, but such as exists is readily disturbed under artificial environment, though it must be borne in mind that even with the typical colon bacillus we have also shown functional modifications to be possible under particular conditions.

That when the members of the colon group are cultivated under circumstances favorable to the development of both the function of fermentation and that of proteolysis, fermentation invariably takes precedence and no evidence of proteolysis is manifested until after fermentation has ceased.

That the cultivation of all the members of the colon group under circumstances that favor the development of one function, viz., that of proteolysis, at the expense of another, viz., that of fermentation, results first in apparent increase of vigor; but this is of temporary duration and is quickly followed by the decline and death of the cell.

The result of this increased activity of the proteolytic function is the formation of much larger amounts of indol by typical colon cultures than has ever been obtained by us by any other method.

By the method of experimentation through which we were enabled to accentuate the proteolytic activity of the typical colon bacillus, as caused by an increase of indol formation, we have also induced the function of indol formation not only in atypical colon bacilli that have been devoid of it but in every specimen of typical typhoid bacilli to which we had access as well.

We feel justified in regarding one of the differential tests between the typhoid and colon bacillus, notably that of indol formation on the part of the latter and the absence of this function from the former, as of questionable value, for the reason, as shown above, that by particular methods of cultivation indol production has been shown to accompany the development of a number of specimens that we have every reason to regard as genuine typhoid bacilli.

As a result of our own experiments, together with the observations of others, there can be no doubt that the bacillus *coli communis* at times possesses pathogenic properties, and that by artificial methods on treatment it may often be brought from a condition of benignity to one of virulence,

The spleen of a typhoid patient has always been regarded as the only trustworthy source from which to obtain the typical typhoid bacillus. While we believe this to be true, still our investigations show that other members of the colon group may also be present in this viscus; in fact, from such spleens we have isolated practically all of the varieties of this group with which we are acquainted.

From our experience the value of the serum test for the differentiation of typhoid and colon bacilli would seem to be questionable. We are inclined, however, to attribute the irregularities recorded above as

due more to the method of application than to defects of the principles involved; for, as stated, by the use of dried blood, as in our experiments, it is not possible to make the test with constant and accurate, or even approximately accurate, dilutions of the serum. Our irregularities may be in part due to this defect. We therefore lay less stress upon this than upon the other features of our work.

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THE VIRGINIA COLONY OF HELIX NEMORALIS.

THE now well-known colony of the European *Helix nemoralis* at Lexington, Va., has twice before been the subject of articles by the present writer. (*Nautilus*, November, 1889, and December, 1894.) It was shown in these articles that many new variations, different from those observed in Europe, had occurred; and the colony consequently became of great interest to students of evolution. Unfortunately, Professor Morrison, who was studying these snails, removed from Lexington in 1890, and, having the misfortune to lose his collection by fire, paid no further attention to the matter. It is only now that I am, through the kindness of Mrs. John M. Brooke, of Lexington, in a position to give some account of the colony subsequent to the date mentioned.

In order that every reader may understand what follows, I will explain the system of band-formulæ used for recording the variations. The typical shell has five bands and the formula is 12345. The absence of a band is indicated by 0, thus 10345. Two or more bands united are bracketed together as (12)345. A rudimentary band is expressed by a small figure below the line, as 1,345. A split band is expressed by doubling the number, as 123345. An extra band, not assignable to any of the normal five, is expressed by a ×, as 123×45.

Mrs. Brooke sends me a series of shells gathered by herself at Lexington in 1896 and 1897. They are as follows:

A. With a yellow ground-color = *libellula*.
libellula 12345.....70.
" 123(45).....21.
" 10345.....10.
" $1_{,}345$ ..... 9.
" 12045..... 6.
" 00000..... 5 sent, but Mrs. Brooke says they are plentiful.
" $12_{,}45$ ..... 4.
" $_{1}0345$ ..... 3.
*" $12_{,}3(45)$ nov. formula.. 2, the formula shows only near the mouth of the shell.
" $_{12}345$ ..... 2.
" (123)(45)..... 2, juv.
" (12)3(45)..... 2, one is juv.
**libellula* $(12)_{,}3_{34}45$ nov. formula,..1, the formula shows only near the mouth.
" $12_{,}3(45)$ .....1.
" 00345.....1. juv.
" $1_{,}045$ .....1.
" 02345.....1.
" 123_{xx} (45).....1.
" 00300.....1.
" $_{1}0300$..... .....1.
" 123_{x} (45).....1, juv.
*" $_{1}(22)045$ nov. formula..1.

B. With fawn-colored ground = *petiveria*.
petiveria 12345.....1. = *brissonia*, Moquin-Tandon.
" 123(45).....1. = *arcelinia* Locard.
" (12)3(45).....1. = *brookea*, n. n.

C. With pink ground = *rubella*.
rubella 00000.....2. Quite pale. Mrs. Brooke says they are extremely scarce.

The three forms above marked with an asterisk are new to the Lexington list, and are all new formulæ of the split-band type, like the previously found new variations in the colony. All of the rest were formerly obtained by Professor Morrison.

The examination of the above list brings out the apparent fact that the new split-band variations are now comparatively rare in the colony, though still much more fre-

quent than such forms are in Europe. On the face of things, it certainly appears as if the colony were reverting to the European type. At the same time, it must be remembered that Morrison's remarkable variations were picked out of a very large number of shells—a far larger number than those sent by Mrs. Brooke. Unfortunately Professor Morrison never published the detailed statistics he had accumulated, but from data he sent me I gather that there were about 100 split-band shells to 2100 others, *i. e.*, about 4.8%. The split-band forms in Mrs. Brooke's lot above are about 4%, and are not nearly so remarkable as many of Morrison's. But Mrs. Brooke probably put aside the best variations; in fact, she sends for my inspection the following, taken by her at Lexington at various times, and new to the list for that locality, three being new formulæ:

rubella 12045. I have taken a young example of this in England—at Beckenham, Kent. The formula was recorded before from Lexington with a different ground-color.

rubella $003_{4}0$. The formula was recorded from Europe by Roebuck.

" 10045. Very pale ground color. A new combination.

petiveria 1 (23)(45). = *goupilia* Moquin-Tandon Also in France.

" 00305 = *gabillotia*, Locard. Also in France.

" (123)(45). = *lowea*. Moquin-Tandon. Also in France, England and Ireland.

" 1(23)(45).

libellula $00(3^{x})00$. nov. formula

" 00305 = *bruguieria*, Moquin-Tandon. Also in France and England (Kent).

" $(12)_{3}3(33)3(45)$ nov. formula. This is the most remarkable shell sent by Mrs. Brooke. It seems to have been found dead, and so may date back to earlier times.

" 003055. The formula has been recorded from Europe by Kreglinger.

" $(12)_{x}$ 3(45) nov. formula.

While the percentage of split-band forms may seem small, European collectors will appreciate their *relative* abundance in the Virginia colony, and the large number of different formulæ in the latter which have not yet been seen in Europe. Very many more split-band formulæ are now on record from the Virginia colony than from the British Islands all together, notwithstanding the collecting that has been done in the latter country.

I regret that it is not possible to definitely assert as yet whether the peculiar variations of the Virginia colony are losing ground, but such seems to be the case to a slight degree at least. Certainly there is no evidence of their increase. Probably Mrs. Brooke will be able at a later date to give us more conclusive statistics.

The reader will observe the names (as *goupilia*, *lowea*, &c.) given to the different combinations of color and banding. These were first introduced by Moquin-Tandon; and many were added by Locard, but a very large number of combinations have no such names. I find that they are rather useful, as they can be remembered better, and are not so easily written or printed wrongly as the formulæ, etc., they represent. If I were writing a large treatise on the variation of *H. nemoralis*, I should be inclined to prefer names to formulæ when discussing distribution and other matters.

The colony of *H. nemoralis* at Burlington, N. J., is very different from the Virginia one, and so far as known contains nothing peculiar. Specimens sent to me by Mr. W. G. Binney belonged to *rubella*, *guettardia* and *cuvieria*.

T. D. A. Cockerell,
N. M. Agr. Exp. Sta.
Mesilla, N. M., April 20, 1897.

CURRENT NOTES ON METEOROLOGY.

NAVIGATION IN FOG.

A paper by Prof. E. C. Pickering, on

'Navigation in Fog,' contains some interesting suggestions regarding the possibility of determining the distance and direction of one vessel from another in a fog by means of a calculation based on the velocity of sound. If, for instance, two fog horns, A and B, are placed, one east and one west of a given point in a north and south channel, and each two miles distant from the point, and these horns are blown simultaneously and automatically at regular intervals of about a minute, a captain who is trying to work his ship through the channel can readily get his bearings. Supposing that one horn has a higher pitch than the other, and that a vessel is one mile east of the channel between the two horns, the captain of the vessel will hear the high-toned whistle A five seconds after it is blown, because it is only one mile distant, but B will not be heard for 15 seconds, since it is three miles off. If both horns are heard together the vessel is in the middle of the channel. Another application of this same method of determining positions of vessels is suggested in the case of one vessel attempting to pass another in a fog, and in the case of the calculation of a ship's distance from shore when the ship's time is within a second or two of that on shore, and when a whistle on shore is blown at the exact beginning of each minute. The determination of the velocity of the wind is also noted as being a useful application of this same method, especially in the case of very high winds, which are apt to injure anemometers. Professor Pickering's suggestions are worthy of serious consideration.

HYDROGRAPHIC OFFICE CLOUD TYPES.

THE Hydrographic Office of the Navy has issued a set of colored cloud views, classified according to the international nomenclature, for the use of its observers at sea. There are twelve different views, printed on one sheet, the whole sheet measuring 23 x 28 inches, and the individual pictures $3\frac{7}{8}$ x $5\frac{1}{4}$ inches. These cloud types are not reproduced from photographs, but from paintings. The set is an admirable one, some of the cloud forms being even more typical than those in the new Cloud Atlas, while the reproduction of the pictures of the original views gives several of the pictures a more natural appearance than the corresponding forms have in the Atlas. The alto-stratus, which in one of the views in the Atlas is yellowish, has its proper color of grayish-blue on the Hydrographic Office sheet. The price of the sheet is 40 cents. The views are also published on separate pages, with descriptive text, bound, and cost 60 cents in that form.

RECENT PUBLICATIONS.

On Obtaining Meterological Records in the Upper Air by Means of Kites and Baloons. A. L. ROTCH. Proc. Amer. Acad. Arts and Sciences, Vol. XXXII., No. 13, May, 1897. 8vo. Pp. 245–251.

An account of the kite work at Blue Hill Observatory and of the ascents in Europe by means of 'ballons sondes.'

Difference in the Climate of the Greenland and American Sides of Davis' and Baffin's Bay. R. S. TARR. Am. Journ. Sci., Apr., 1897. Pp. 315–320.

The Greenland side has the milder climate, owing to ocean currents and winds.

Meterologie. W. GRABERT. Leipzig, 1896. Small 8vo. Pp. 149.

Although much condensed, this new text-book is well written and presents the newest theories and facts.

NOTE.

Owing to the departure of the compiler of these notes for a somewhat extended scientific tour in South America, the regular publication of the *Current Notes on Meteorology* will be suspended during the next six months.

R. DEC. WARD.

HARVARD UNIVERSITY.

CURRENT NOTES ON ANTHROPOLOGY.

THE ANTIQUITIES OF BORNHOLM.

BORNHOLM is an island in the Baltic sea, about 23 miles long, under the government of Denmark. A study of its antiquities has been published at Copenhagen this year by E. Nedel, a continuation of his previous publications (Efterskrift til Bornholms Oldtidsminder, quarto, pp. 166. Illustrated).

This local study has a general interest not merely for the abundant material it presents for comparison, but for the very regular superposition of archæologic layers it reveals, from an early stone age through the bronze age and the first and second iron ages. The earlier stone relics are cutting instruments of an extremely primitive model, where the cutting edge is produced by the natural cleavage of the stone without any attempt at chipping or rubbing. It is not clear from the text whether a stratum was found containing these exclusively, as it is well known such *teshoas*, as they are called in American archæology, occur in all periods.

These researches do not carry the antiquity of man in the locality beyond the manufacture of pottery and the domestication of animals, therefore not beyond received dates. The volume is handsomely illustrated and a fine example of antiquarian work.

THE CHACO TRIBES.

ATTENTION has been called several times in these notes to the studies of Lafone Quevedo on the ethnography and dialects of the tribes inhabiting the Gran Chaco. In a private letter received from him recently he remarked that the problem of the relationship of the Chaco languages is now virtually solved, although some corners of the area remain a little obscure from lack of material.

The languages are divided into two great groups, morphologically distinct, the one expressing the grammatic relations by suffixes, the other by prefixes.

I. Suffixal group.
   1. Lule (extinct).
   2. Vilela (or Chulupi).

II. Prefixal group.
   1. Abipone.
   2. Mocovi.
   3. Toba.
   4. Mbaya (and probably Mataco, Payagua and Lengua).

The prefixal group belongs to the great Guaycuru stock, as I have classed its members in my 'American Race,' p. 315.

A large amount of linguistic material has been collected by Lafone Quevedo, and it is to be hoped that it will soon be published for the benefit of the scientific world.

THE CELTS AND THEIR WANDERINGS.

THIS question has been several times discussed in these notes, and, as it is a primary one in European ethnography, it is well to quote, from the 'Centralblatt,' the results of the latest studies presented in an article of H. Mollier, of Lyons.

Five hundred years B. C. the Celts possessed central Europe, from the Rhine to the Danube, and from the North Sea to the Alps. About a hundred years later, pressed by Germanic tribes on their north, two streams of migration poured out from them—the one into Italy, Illyria, southern France, northern Spain, and northern Britain; the second, continuing several centuries, into Belgium, northern France and southern Britain.

The primitive physical type of the Celt was tall in stature, skull dolichocephalic, hair blonde and complexion fair. The fact that the southern branch, especially in France, so widely departed from this, was owing to their constant intermixture with the Ligurians, who are supposed to be non-Aryan, and other peoples descended from the ancient dwellers in the stone age. The primitive Celts were, of course, closely allied

with the primitive Germans. Broca's Celtic type is in fact Ligurian, and the Galatæ were true Celts, with the original blonde traits. D. G. BRINTON.

UNIVERSITY OF PENNSYLVANIA.

SCIENTIFIC NOTES AND NEWS.

THE Senate Committee on International Expositions has reported a bill providing for the representation of the United States at the Paris Exposition of 1900, and recommending an appropriation not to exceed $500,000. As reported, the bill provides for a Commissioner-General at a salary of $10,000 a year, an Assistant Commissioner-General at $6,000, and ten scientific experts at $2,500 a year each.

A BIOLOGICAL station containing aquaria, laboratories, rooms for collections and library is in course of erection near Sebastopol, on the Black Sea. It is expected that the building will be opened for scientific work during the present year.

THE third circular issued by the general committee of the Seventh International Geological Congress recommends that special attention be given to a unification of geological and petrographic nomenclature. The guide to the excursions is expected to appear immediately, and will extend to about 500 pages, with many maps and illustrations. The free tickets on the railroads will be valid from July 22d to October 17th. It is stated that university students cannot take part in the excursions, but there will doubtless be accommodation for all geologists. The excursions to the Ural regions and to the Crimea are each limited to two hundred persons.

ACCORDING to the New York *Medical Record* the following are the names of those who have been invited to deliver orations at the general sessions of the Moscow Congress: Lauder Brunton, of London, on the 'Relationship between Physiology, Pharmacology, Pathology and Clinical Medicine;' Nicholas Senn, of Chicago, on the 'Diagnosis and Surgical Treatment of Acute Forms of Peritonitis;' Krafft-Ebing, of Vienna, on the 'Etiology of Progressive Paralysis;' Danilevski, of Khartov, on 'The Action of Electric Rays on the Animal Organism at a Distance;' Lombroso, of Turin, on 'New Horizons in Psychiatry;' Leyden, of Berlin, on the 'Present Modes of Treating Consumptives and their State Control;' Herzen, of Lausanne, on the 'Significance of Physiological Psychology for Medical Education. Robert, of Barcelona, and Lukianov, of St. Petersburg, have not yet announced the titles of their addresses. Virchow, of Berlin, and Roux, of Paris, have been invited to deliver orations, but no word had been received from them by the Moscow committee at the time the above announcement was made.

PROFESSOR M'KENDRICK, of the University of Glasgow, has been awarded the MacDougall-Brisbane prize by the Royal Society of Edinburgh in recognition of his published researches in connection with sound and the phonograph.

DR. HADDON has been granted £300 from the Wort's Travelling Scholars' Fund, of Cambridge University, for an anthropological expedition to the Torres Straits.

PROFESSOR VIRCHOW is at present at Brünn, engaged in examining the prehistoric remains in the neighborhood.

IT is reported that Mr. Edward McIlhenny, accompanied by Mr. W. E. Snyder and Mr. Norman G. Baxton, proposes to leave San Francisco on June 25th for Point Barrow, Alaska. He expects to spend two years making collections of the fauna and flora of northeastern Alaska. It is said that the collections are for the National Museum and the University of Pennsylvania.

DR. FRITZ MÜLLER, the botanist, died at Blumenau, Brazil, on May 21st, at the age of 76 years. Dr. J. Lewis Smith, formerly clinical professor of the diseases of children in the Bellevue Hospital Medical College, and the author of many contributions to this subject, died in New York on June 11th, at the age of 69 years. M. Leopold Maney, correspondent of the Paris Academy for geography and navigation, died in May.

THE works of Alvan G. Clark & Sons will be continued under the supervision of Mr. Carl Ludlin, who for twenty-five years has been engaged as a maker of lenses under the firm.

THE Board of Trustees of the University of Rochester have sanctioned the establishment of

a fresh-water biological station at Hemlock Lake, under the direction of Professor Charles W. Dodge.

An International Congress of Librarians will be held in London from 13th to 16th of July. Dr. Melvil Dewey will be one of the representatives of the United States government.

There has recently been opened at the Crystal Palace an exhibition in commemoration of the Diamond Jubilee of Queen Victoria, in which the progress made by science during the reign is said to be well represented.

The Rev. Professor Wiltshire has presented his valuable geological library, containing about 1,500 volumes and pamphlets, to the Woodwardian Museum, Cambridge University.

The Drapers' Company has offered to erect a new building for the accommodation of the Radcliff Library at Oxford, at a cost of £15,000.

The library building of the University of Iowa was struck by lightning on June 19th and destroyed by fire. The physical laboratory was on the first floor of the building. The total loss is estimated at $100,000.

The second 'International' *Congrès olympique* will be held at Havre during the last week of July. The subjects to be discussed are physical exercises and games in their relation to pedagogy and hygiene.

A Röntgen Society was inaugurated in London on June 23d. Professor Sylvanus P. Thompson was elected President, and forty-four members were enrolled, of whom about one-half were made officers.

The *Academy* states that the third part of the late George John Romanes' 'Darwin and After Darwin' is in the press. The subject-matter consists of post-Darwinian questions, Isolation and Physiological Selection.

A number of Swedish zoologists have prepared a volume of contributions to zoology as a *Festschrift* on the occasion of the eightieth birthday of Dr. Wilhelm Lilljeborg.

The annual visitation of the Royal Observatory at Greenwich took place on June 5th, and the Astronomer Royal submitted his annual report for the year ending May 10th.

As we have announced, a census of the Russian Empire was taken on February 9th, none having been taken since 1851. The total population is now given as 129,211,113, having about doubled in a period of forty-six years.

At the annual general meeting of the Victoria Institute on June 2d, Lord Kelvin made an address on the 'Age of the Earth as an Abode fitted for Life.' Lord Kelvin maintained the position taken by him thirty years ago, that this earth could not have been a habitable globe for more than thirty million years.

It is reported that Professors Koch's antitoxin treatment for the rinderpest has proved to be of no value. Nine-tenths of the cattle north of Cape Colony have been exterminated, and it is feared that Cape Colony will fare no better. There is great mortality from fever in the region, supposed to be due to pollution from the numbers of cattle which have died from rinderpest.

The *British Medical Journal* states that at the conference of Ministers of Agriculture representing the Australian colonies, recently held at Sydney, it was decided that the colonies combine in offering a reward of £5,000 to any person who discovered and made known a satisfactory remedy for the tick disease which has caused so much destruction amongst cattle.

The New York *Independent* addressed a number of 'representative' men and women, asking what, in their opinion, was most characteristic of the period of Queen Victoria's reign. As might be expected, the replies differ greatly, one holding it to be the growth of democratic politics, another the security that has been given to the monarchy, one the grinding, bleeding system of rule in India, and another the growing attachment between the mother country and her colonial empire; but one-half of those who reply, including such diverse points of opinion as those of President Eliot and Madame Patti, hold that the most important characteristic of the past sixty years is the progress of science and its applications. In the same number of the *Independent* there is published an admirable article by Professor Newcomb on 'Science during the Victorian Era.'

THE General Secretary of the Italian Geographical Society asks us to contradict the report that Dr. Nansen did not lecture at Rome because the Society was unable to pay the expenses. The Society conferred upon Dr. Nansen its great gold medal, a silver medal on each of the officers and a bronze medal on each of the men. Dr. Nansen, in a letter from Christiania (April 21st), expressed his thanks for the honor, and his regrets for being unable to go to Rome to receive them, as he should have liked very much to do had his time allowed, as he hopes it will on some later occasion.

THE plans of operation for the United States Geographical Survey for the ensuing year, which were formulated by Director Walcott as soon as the Sundry Civil and Indian Appropriation Bills became laws, have been approved by the Secretary of the Interior, and the Survey's work in the several branches for the field season of 1897 and the fiscal year is now under way. Following is a synopsis of the sums appropriated for the Survey in the bills named and the purposes for which they are used: For topographic surveys in various portions of the United States the Sundry Civil Bill carries $175,000; for geologic surveys and researches pertaining to the geology of the country, $100,000; for the continuation of the investigation of the gold and coal resources of Alaska, $5,000; for paleontologic researches, $10,000; for chemical researches, $7,000; for gauging streams and determining the water supply of the United States, $50,000, and for the annual report of the mineral resources of the United States, $20,000. There are also in this bill the usual allowances for engraving and printing, preparing illustrations, etc. In addition to these items, which relate to lines of work already under way and carry the same sums as are carried in the bill for the present year, there are in the Sundry Civil Service bill just passed provisions for new or special work as follows: For surveying the public lands designated by Executive order as forest reserves, $150,000, and for surveying the boundary line between the States of Idaho and Montana, $7,650. In the Indian bill there is an item for completing the topographic and subdivision surveys of the Indian Territory, $100,000. This has reference to the survey of the lands of the Choctaw, Creek and Cherokee Nations, which was begun in April, 1895. There is also in the same connection provision for the resurvey of the lands of the Chickasaw Nation, in the same Territory, $141,500, or in all for the Indian Territory surveys, $241,500. Of the provisions for new work above mentioned, the only one that is of special importance is that relating to the survey of the public lands designated by the President as forest reserves. This provision grows out of the prolonged contest in Congress on the subject of the disposition of the forest areas of the West, and the question of abrogating or modifying President Cleveland's order of February 22, 1897, setting aside a number of forest reserves. Congress suspended certain of these great reserves and the work is to be confined to these. There is to be a topographic and subdivision survey, followed by a survey of the forest areas. The appropriation for this work, like the appropriation for most of the Survey work, was made immediately available, and the work will not have to wait until July 1st. The delay in the passage of the appropriation bills will have the effect of shortening the field season of the Geological Survey a month or two and, it is presumed, will somewhat curtail the output of work, at least in some directions. The Indian Territory survey, which has been going on in the field and in the office all the year round since it was commenced, has suffered quite appreciably, it is understood, owing to the peculiar conditions governing it. The appropriation for this work for the year 1896–97 was practically exhausted in April, and for two months the work was under suspension.

PROFESSOR EDWARD L. NICHOLS, President of the New York State Science Teachers' Association, has, in accordance with the vote of the Association at its last meeting, appointed a committee of nine to consider and report at the next annual meeting on the following topics: (1) Science as an Entrance Requirement to Colleges; (2) Science Teaching in the Secondary Schools; (3) Nature Study in Primary Schools. The following are the members appointed: Leroy C. Cooley, Chairman; Albert L. Arey, George F. Atkinson, Anna B. Comstock, Rich-

ard E. Dodge, William Hallock, Charles B. Scott, Ralph S. Tarr, John L. Wilson.

We learn from *Natural Science* that the sixth meeting of the *Nederlandsch Natuur en Geneeskundig* Congress, corresponding to the American and British Associations for the Advancement of Science took place at Delft, on April 22d, 23d and 24th. The general President was Professor J. M. Telders, and the five sections were presided over respectively by W. A. van Dorp, of Amsterdam; W. Kapteijn, of Utrecht; P. P. C. Hoek, of Helder; H. Treub, of Amsterdam, and K. Martin, of Leyden. The sectional meetings were held in the various laboratories and lecture-rooms of the Polytechnic School, in both morning and afternoon. Several of the sections had very attractive programs; among the most interesting papers in Section II. (Biology) may be mentioned one by Professor Hubrecht on 'Primates and Lemurs,' and one by M. C. Dekhuijzen, of Leyden, on methods of investigating the micro-organisms in fresh water. The Section for Physics and Chemistry had an able paper by Col. C. F. Geij van Pittius, on various explosives, and one by H. A. van Ijsselstein on an interesting form of telephone. The paper which formed the last of the series on Saturday was of special interest, a lecture by Professor M. W. Beijerinck, on luminous bacteria.

UNIVERSITY AND EDUCATIONAL NEWS.

It is rumored that a union between New York University Medical School and the Bellevue Hospital Medical College will not be carried into effect.

The name of the Maine State College at Orono has been changed to the University of Maine.

Dr. J. L. Goodnight, who has been President of the West Virginia University, at Parkersburg, for two years, and Dr. J. A. Myers, who has been Director of the State Experiment Station for nine years, have been removed by the Board of Regents of the University. It is said that this action is due to political reasons.

Dr. James Woodrow, on reaching the age of seventy years, has resigned the presidency of South Carolina College. President Craighead and Professors Tompkins and Wright have resigned from Clemson College. President Craighead has been elected President of the College of Wisconsin. Dr. W. H. Hervey has resigned from the presidency of the Teachers' College, New York.

Professor A. C. Armstrong, now professor of philosophy at Wesleyan University, has been appointed to a professorship in the department of history in Princeton University. E. M. Weyer, of the University of Leipzig, and M. Matsumoto, of the University of Tokio (Japan), have been made assistants at the Yale Psychological Laboratory. Mr. Muir, now of Halifax University, has been appointed to the chair of psychology in Mount Holyoke College.

The American Society for the Extension of University teaching offers at the University of Pennsylvania a summer meeting from July 6th to 30th. Thirty-eight lectures are announced, and many of the courses will prove of scientific interest. Conferences on the teaching of geography will be led by Professors W. M. Davis and R. E. Dodge. Professor W. F. Magie will give two lectures on Mediæval Science. Professor J. T. Rothrock will lecture on forestry and Professor W. P. Wilson on Museums. In psychology, courses of lectures are announced by Professor Lightner Witmer, Professor J. Mark Baldwin, Professor E. B. Titchener, Mr. R. P. Halleck and Miss Laura Fisher.

The New York Board of Education has announced the courses of study for the three new high schools which will be opened in September. Three courses are offered—classical, commercial and general. The first mentioned fills the requirements of the classical courses in the colleges and includes five hours in physics or chemistry in the fourth year. The commercial course requires two hours in physiology and four hours in biology in the first year and three hours in physics in the second year. The general course offers a larger number of electives. A student can take four hours in science in the first year, seven in the second, four in the third and four in the fourth. It is not clear to us why the student in the third year may take fifteen hours in languages and in the fourth year nineteen, while he is confined to four hours in science.

DISCUSSION AND CORRESPONDENCE.

IS THE LOESS OF EITHER LACUSTRINE OR SEMI-MARINE ORIGIN?

TO THE EDITOR OF SCIENCE: Mr. Hershey, in your issue of May 14th, urges anew the claims of the lacustrine and submarine hypotheses for the origin of that still problematic deposit, the loess. The former has been considered for the last forty or fifty years, and the barrier has not yet been found to separate it from the sea. The latter has been discussed for twenty-five years or more, and no trace of marine fossils have yet been found to corroborate it, though if it were true nothing would seem easier.

The undersigned committed himself to the lacustrine view in 1875 by naming a hypothetical lake covering the loess of western Iowa and Nebraska, Lake Missouri.* Even as late as 1891† he argued for a similar body of water for the deposition of the extramorainic drift as well as of the loess of the same region. But a study of Lake Agassiz and of Lake Erie satisfied him that the position was untenable. Perhaps the strongest reason for changing his opinion was the absence of all shore lines, like beaches or cut slopes. These are a conspicuous feature in the cases studied, but none have been found connected with the loess. When we think how a single storm builds a beach ridge sometimes on the shores of lakes no larger than the one postulated; when we remember, also, how little eroded much of the plateau of northern Missouri seems to be, we can accept neither his suppositions that they may have been entirely removed by erosion, nor the still more improbable one that no beaches were formed, "because the shore line did not remain at one level a sufficient length of time." In his appeal to western Florida as an instance of the latter case he admits that the surface is 'undulating,' which rouses the suspicion that a more comprehensive study of it would prove that character to be the result of beaches much eroded, though probably modified by dune action, and possibly by solution of the underlying rock.

He refers to a deposit which he has observed 1,000 feet A. T. between Cuba and Pacific City, Mo., as closely resembling the 'upland loess' of northwestern Illinois. Before we admit the extension of a loess-depositing gulf to that altitude—for such a body of water as would cover that and the clayey loam of Illinois could not have been separated from the ocean—let us consider some of the things involved in such a view. It involves the submergence of St. Louis 500–600 feet, of northern Illinois nearly the same, unless there was an elevation in that direction instead of a greater depression, as has been more commonly argued. It implies strong wave action, especially around the Ozark uplift. It implies remarkably discriminating erosion to have removed so completely the loess and drift from the nooks of that irregular shore, when it failed to do so from the slopes and summits almost overhanging the gorge of the Missouri in Boone county, Mo., or that of the Mississippi, in Pike county.

Before entertaining so violent a supposition, why not refer the Cuba deposit to some local lake, such as may be found in any residuary area, or to an 'adobe' formation, or to 'æolian loess,' which no doubt accumulates in many localities to moderate thicknesses.

Moreover, the gulf theory demands that the sea submerged points, 1900–2000 A. T. in northeastern Nebraska, and 1300–1400 in northeastern Iowa. And this, too, in regions which shortly before and not long after had vigorous streams flowing at considerably lower levels.

Against the fluvio-lacustrine or flooded river theory for the Missouri 'upland loess' Mr. Hershey presents the objections, first, that it was 'laid down on an undulated upland, dissected by valleys,' and second, the 'inequalities, when considered over broad areas, of the surface of the sheet of loess or loam.' The former must be more or less true in any superimposed drainage. And any alluvial plain is far from even or level. The delta of the Mississippi has a general slope toward the sea of eight inches to the mile, with local slopes for a few miles five times as great. The fluctuations of water level have a range of 50 feet or more in some places. Moreover, when we become acquainted with the habitual creeping, or glacier-like, movement of clays and

* Proc. A. A. A. S., 1875.

† Proc. Iowa Acad. Sci., 1891, p. 5, and Am. Geol., 1892.

loams, it does not seem so incredible that the loess and clayey loam are the delta-like accumulation of great streams, fed from the glaciers on the north and the Tertiary silts on the west.

I am surprised to learn from Mr. Hershey's letter that in northwestern Illinois the 'upland loess' 'is present over the thick terrace-like deposits of true loess down along the streams.' Chamberlin and Salisbury, as I understand, make the terraces *subsequent* to the former, and however that may be in that region, there is clear evidence from fossils and rearranged material that such is the case along the Missouri. It is a common thing for all terraces to be capped by a finer loam, the last deposition of the flood which laid down the coarser material below, or of some subsequent flood which barely submerged them.

Mr. Hershey assumes without question the preglacial age of the troughs of the Missouri and Mississippi through this region. This has not yet been proved. The evidence to the contrary is given at some length in my report which he reviewed, and I need not repeat here. I would add only a few words. The rock bottom of the Missouri through the State of Missouri, and of the Mississippi below the mouth of the Des Moines, is nowhere known to be lower than is known to be sometimes reached by 'the scour' in floods of the present day, viz., 80 or 90 feet.

The interesting preglacial channel west of Keokuk, first reported by General Warren, is interesting, but instead of proving that most of the present Mississippi channel is preglacial, rather shows the contrary, for its course at Quincy and below corresponds in depth and size with the new channel at Keokuk rather than the old one, and that has evidently been cut since the glacial epoch. We may as reasonably search for the continuation of the old channel toward the east as toward the south, for bed rock opposite Quincy is 45 feet below low water.

Before closing I would state that I am not over-confident concerning the Osage-Gasconade divide, and am only sorry that circumstances have not permitted my further study of the problems involved. But as far as our present knowledge goes, it still seems to me much more tenable than the theory which I understand Mr. Hershey to propose.

J. E. Todd.

State University, Vermilion, S. D.,
May 31, 1897.

A MONUMENT TO THE LATE BUYS-BALLOT.

To the Editor of Science: The Royal Dutch Meteorological Institute is about to remove from the old buildings at Utrecht, where, during forty years Professor C. H. D. Buys-Ballot labored so indefatigably for meteorology, to the new establishment at de Bilt, near Utrecht. Buys-Ballot, who may be called the founder of meteorological science in the Netherlands, is known to students of that science the world over from the law bearing his name, which connects the direction of the wind with the position of the storm center. His noble character, combined with a charming personality, endeared him to his colleagues, and won the respect and affection of a wide circle of acquaintances, which included the writer. A provisional committee, composed of his former associates, believing that the memory of such a man is honored outside of his own country, has invited an international committee to aid in obtaining funds for the erection at Utrecht of a monumental bust of the great meteorologist. The American members of this committee are Professor Willis L. Moore, Chief of the United States Weather Bureau at Washington, and the undersigned. Subscriptions sent to either one of us will be acknowledged and forwarded to the Dutch committee.

A. Lawrence Rotch,
Director of the Blue Hill Meteorological Observatory, Readville, Mass.

ORGANIC SELECTION.

I am unable to agree with Mr. Robert M. Pierce that the passage he quotes from Mr. Herbert Spencer's 'Principles of Biology' sets forth the same conception that Professor Mark Baldwin dealt with in Science for April 33d. Mr. Spencer's position, I take it, is this: Acquired characters are inherited; there is a natural selection of acquirers, the fittest of whom survive to transmit their acquired characters; hence evolution is rendered more rapid than it would otherwise be. This is primarily

Lamarckism, with natural selection as 'a secondary agent,' and as such it differs widely from the hypothesis with which Professor Mark Baldwin is concerned.

C. LLOYD MORGAN.

UNIVERSITY COLLEGE, BRISTOL, ENG.

SCIENTIFIC LITERATURE.

A Treatise on Rocks, Rock-Weathering and Soils. By GEORGE P. MERRILL. New York, The Macmillan Company. 1897. Pp. 411. 25 pls., 42 figs. in text. $4.00.

Professor Merrill is already known to the public as the author of 'Stones for Building and Decoration,' of a guide to the geological collections of the United States National Museum, and to geologists as well by his valuable contributions to the subject of rock-weathering. The present work is a résumé of his own investigations of rock disintegration and decomposition rounded out by an abstract of the literature of the subject. The book is a welcome addition to the already numerous aids to the study of rocks. It is particularly important in its bearing upon the sedimentary rocks and the soils which have not as yet received the careful examination which has been bestowed upon the igneous rocks.

The author's plan is in its outlines simple and logical. The igneous rocks are treated as what may be termed original rocks, from which all others are derived. Following them is a description of the metamorphic, vein and clastic rocks. After this is given the manner of disintegration and decomposition of these rocks. In general, the text follows a natural cycle of change in those rocks which are exposed to the direct action of the atmosphere and surface processes.

Unfortunately, the details of the plan have led to much repetition of subject-matter, which might have been avoided by a little attention. This duplication is particularly brought to mind by the similarity of the phrase when it appears. Thus we read in regard to slaty cleavage:

P. 155. In such cases the bedding is not infrequently indicated by the dark bands or 'ribbons' which are so evident on a split surface.

Again:

P. 171. In such cases the true bedding plane is often determined only by the dark bands, or ribbons, by which the split slates are traversed.

Eskers and kames are described on p. 290 and again on p. 356 in essentially the same words.

Some terms are used before they are explained, as, *e. g.*, metamorphism, in the introductory chapter. This is particularly noticeable in the notes upon the occurrence of minerals and from the pedagogical standpoint is a defect in the book. Furthermore, it is redundant and unnecessary, since the information is given again in its proper place in the chapter on rocks.

A few passages in the text are so clearly ambiguous as to be explained only on the ground of careless proof-reading. Thus, on p. 108, there is the meaningless statement concerning the manganese oxides, "which, though wide in in their distribution, are found in such abundance as to constitute rock masses in comparative rarity."

Again, on p. 36, we read of concretions "which may not so closely simulate animal forms as to be very misleading." *Often* for *not* in this sentence would bring the statement into the realm of the understanding. More blind yet is the statement on p. 236 that "oligoclase always gave way before the oligoclase."

There are several other slips which one may expect to find in a first edition, as, on p. 64, the phrase 'apparently evident,' and on p. 292, "where the included débris is deposited on melting," the context shows that we should read 'on the melting of the ice;' on page 163 we find *Eozoon Canadenses* for *Eozoon Canadense*, elsewhere correctly given.

On p. 393 the reference to the 'common earthworm' is sufficiently clear without the parenthetical phrase, 'the angleworm of the New England disciples of Izaak Walton,' ten words of undisguised padding.

The statement on p. 356 regarding the Rhone would lead a student unfamiliar with the course of that river to suppose it was a subglacial stream, like the Yahtse in Alaska perhaps, whereas only its uppermost torrential portion occupies this relation to the ice. But the English of a scientific book is perhaps something aside from its real self. Happily there is less

to find fault with in regarding the book from this standpoint.

The chapter on Igneous Rocks is a handy compendium of recognized types. The classification makes mode of occurrence and age of secondary importance, and in this respect differs from while it gains in clearness upon the classification of Rosenbusch. While this portion of the book is rich in reference to rock types, it will hardly serve (as the author himself indicates by reference to special treatises) as a means of identifying igneous rocks.

The chemically formed rocks are described along with the clastic rocks under the heading of Aqueous Rocks. From the point of view of the genesis of these two groups of rocks it seems objectionable to classify them in this manner. Many of the chemically formed rocks are closely allied to the igneous rocks. Moreover, in geology, the term 'aqueous rocks' has been from the days of Lyell intimately associated with the fragmental rocks alone. The same extension of use for this term would embrace igneous rocks, in which the action of water is largely concerned.

It is to be noted that Griswold is misquoted in regard to the origin of the novaculites of Arkansas. Instead of supposing these rocks to be 'a chemical deposit in the form of a siliceous slime on a sea-bottom' (p. 111), this geologist, according to the very report quoted by Professor Merrill, makes the novaculites a deposit of very fine fragmental silica, almost without other materials laid down far from the shoreline in the form of mud or ooze. In the case of other quotations it is sometimes doubtful as to which author the work in a certain district is to be referred. One must look up these references, as, of course, the exhaustive student will take care to do.

The author introduces a few terms not before used in text-books. Colluvial, a name proposed by Professor Hilgard and here restricted to talus and cliff débris and avalanche material, appears to be inappropriate for deposits which owe their transportation to gravity rather than to running water. The time has undoubtedly come when this class of detritus should be given a distinctive name implying the mode of deposition, but the idea of water action, so clearly expressed in *colluvial*, is contradictory to the essential fact which distinguishes these deposits from alluvium. Regolith is a term proposed by the author for the superficial deposits or unconsolidated materials, the products of disintegration and decomposition. It is difficult to realize that this term has advantages over those it is designed to displace, since the superficial deposits of the earth form a very imperfect *blanket*, pierced by every outcrop of bed-rock and mountain peak, worn through along every rocky river bed and sea-cliff. We might take a hint from the quarryman's 'topping' and our 'epigene processes' to speak of the *epilith*, if we must have a Greek word for the 'waste' of the land.

Professor Merrill clearly points out the difference between metamorphism and weathering, and between atmospheric decay proper and those deep-seated changes which are sometimes included under this head.

Special importance is attached to the distinction between decomposition and disintegration in the case of the feldspars. Orthoclase may pass into the state of fine silt without actual decomposition. Such breaking up must be distinguished from decomposition, as it takes place in the lime-soda feldspars. Fournet is quoted as stating that hornblende yields less readily to decomposition than feldspar, while Becker holds the opposite as true. It may be noted here that in the Carboniferous arkoses of New England, derived from disintegrated hornblendic granitites, hornblende is invariably absent from the bleached basal sediments, the feldspar fragments having been evidently strong enough after the breaking down of the granitite to withstand transportation along with grains of quartz. It can hardly be said that the heavier but smaller hornblende grains would be altogether assorted out from the quartz and feldspar by mechanical means. The hornblende must have decomposed before the transportation of the particles.

The concretionary forms of joint-blocks in some igneous rocks and the huge granite bosses are thought by Professor Merrill to be alike an effect of weathering. Even the spheroidal structure of basalt, though admitted in deference to the opinion of some writers to be an original structure, is apparently in the author's

mind when accompanied by a weathering of the rock, to be regarded as a secondary effect.

All that Professor Merrill has to say regarding the processes and products of weathering is timely and important. From the difference in kind of weathering in cold and warm climates, a matter which has been studied by the geologists of India, it is pointed out that the study of the sedimentary rocks may be made to furnish a clue to past climates. It is to be regretted that there is not a chapter on the application of this principle to ancient rocks. The writings of Pumpelly, the work of Willis, Hayes, Campbell and others, together with the published evidence of ancient periods of base-levelling with peneplains and their complementary clastic records, constitute a basis for an interesting and valuable résumé.

As an extension to the treatment of the subject of rock-weathering in standard text-books on geology, this work can well be recommended to the student. For the student of agriculture and soil problems, it will probably give him as much of geology as he needs to know for practical purposes.

The book is well illustrated with diagrams and photographic reproductions. The mechanical execution of the book leaves nothing to be desired. There is a fairly complete index of authors cited and of subjects.

J. B. WOODWORTH.

HARVARD UNIVERSITY.

Bird Life; A Guide to the Study of Our Common Birds. By FRANK M. CHAPMAN. With seventy-five full-page plates and numerous text drawings by ERNEST SETON THOMPSON. New York, D. Appleton & Co. 1897. 12mo., cloth, pp. xii + 269. $1.75.

Confessedly addressed to the uninitiated rather than to the scientific ornithologist, this little volume nevertheless possesses an attraction for anyone interested in birds. The author apparently aims to present his subject in such a manner as to aid and incite further study and observation, the numerous footnote references in the first part of the book rendering the literature on the various subjects easily available. The whole is pleasantly written, and in language sufficiently untechnical to be easily comprehended. The first seventy-three pages treat of birds in general; the rest contain accounts of more than a hundred common Eastern species. The opening chapter briefly outlines the place of birds in nature, first with reference to their taxonomic position and phylogeny; then with reference to their relations to man, as profitable objects for scientific study, as valuable and efficient aids of the agriculturalist and as beings that appeal strongly to the æsthetic emotions. Under another caption are discussed the 'Factors of Evolution,' this being succeeded by an enumeration of the principal forms, variations and uses of the wing, the tail, the feet and the bill, illustrated by numerous text figures. In a chapter on the 'Colors of Birds' are detailed the changes and differences in colors due to age, season, molt, food, climate, haunts, habit and sex. Migration forms the subject of Chapter IV., and is discussed with regard to extent, manner and origin. This is followed by a short treatise on the 'Voice of Birds,' attention being called to both song and call notes. Under the next heading, 'The Nesting Season,' the value of observations during the breeding season is emphasized, and the time of nesting, mating, the details of nest and eggs and the care of the young, each in turn receive attention. Instructions on 'How to Identify Birds,' with suggestions upon points for observation, are also added, together with a field key to common land birds of the eastern United States, this taken, with additions and alterations, from the author's 'Handbook of Birds of Eastern North America.'

In the remaining portion of the book particular attention is devoted to some 125 species, these little biographies ranging from a few lines to nearly a page and a half, with usually a short account of the family to which each belongs. A number of other birds are incidentally noticed.

The 75 full-page plates with which the volume is adorned figure 99 species. In praise of their artistic finish, fidelity of form and minuteness of detail much might be said, and, though all are not of equal excellence, we are inclined to consider as not extravagant Mr. Chapman's claim that for beauty and accuracy these, as a whole, excel any black and white bird drawings that have ever been published in this country.

Furthermore, we think it not too much to say that the illustrations alone are more than worth the price of the book. Beneath each plate are added essential particulars of the size and colors of the species represented, this being evidently intended to supply, for purposes of identification, what is lacked by the pictures themselves.

In a work of such general excellence we are somewhat surprised to notice certain careless statements, as, for instance, that the number of shore birds known is 100, instead of more than 250; that the species of kingfishers are 108, instead of about 200; and that those of humming birds are 400, whereas above 500 really exist. These slips are, however, too few and of too little consequence to seriously detract from the value and usefulness of the volume. It is without doubt the best guide to the study of birds yet published, in this country at least, and should prove, as surely it will, indispensable to the beginner in ornithology. Furthermore, it can scarcely fail to increase the author's already enviable reputation for the felicitous combination of scientific accuracy with popular description.

Harry C. Oberholser.
Washington, D. C.

SCIENTIFIC JOURNALS.

AMERICAN JOURNAL OF SCIENCE.

The July number opens with a paper by A. de Forest Palmer, Jr., on the pressure coefficient of mercury resistance. The author calls attention to the discrepancy existing between the only determinations of the pressure coefficient previously published, namely, those of Barus, who obtained .00003 for the commercial mercury up to 400 atmospheres, and Lenz, who found .0002 for pure mercury between one and sixty atmospheres. In the experiments here described the mercury was carefully purified and distilled in a vacuum, and the pressures were obtained by means of the 'Screw compressor' of Barus, which is capable of indicating pressures up to something over 2,000 atmospheres. The Carey Foster method of measuring resistance was found most reliable. The results of the experiments are contained in two extended tables, and are further tabulated in a special chart. Taking β as the increment to unit resistance of one atmosphere increase in pressure, the equation obtained is as follows:

$$\beta = -.0000332 - 5 \times 10^{-9} t$$

where the last term, owing to its extreme smallness, is probably only approximately accurate. This result is very closely that of Barus, and the difference can be accounted for by the slight impurities in the commercial mercury used by him.

C. R. Eastman describes, with a series of figures, some remarkable Ctenacanthus spines from the Keokuk Limestone. Theo. Holm gives a fifth paper of his Studies in the Cyperaceæ, devoted to *Fuirena squarrosa* Michx. and *F. scirpoidea* Vahl. It is accompanied by two pages of illustrations. S. L. Penfield, of New Haven, and A. Frenzel, of Freiberg, Saxony, have a paper in which they show that the mineral chalcostibite (wolfsbergite) is identical with guejarite; they further give a detailed description of the form of the chalcostibite from Huanchaca, Bolivia.

H. W. Fairbanks has two papers, the first describing a striking case of contact metamorphism on Black Mountain, of the El Paso range, a spur of the Sierra Nevada Mountains, extending easterly into the Mojave desert. This is illustrated by a figure showing the diabase dike, with a slaty zone adjoining, of hard, firm rock, into which the soft tufa has been baked. The second paper describes the tin deposits at Temescal, southern California. The tin deposits here lie nearly in the center of a rudely semicircular area of granite about two miles in diameter and connected on the east with the great body of similar rock extending indefinitely in that direction. The sedimentary rocks along the edge of the granite area consist of quartzite, mica schist and conglomerate of unknown age. A part, at least, of the slates and limestones of the Santa Ana range are Carboniferous. The semicircular area of granite and portions of the adjoining porphyry have been fissured in a general northeast and southwest direction along almost innumerable lines, and a black vein matter deposited. The veins are generally small, varying from one-fourth to a few inches in thickness, but in the case of the main tin-bearing vein an enormous size is reached at Cajalco

Hill. As the hill is approached the veins become larger and finally culminate in this elevation, which is about 300 by 250 feet in diameter at the base. The veinstone of which it is mostly composed rises in prominent and bold croppings. With one or two unimportant exceptions, the material of which this, as well as the other veins, is formed consists wholly of tourmaline and quartz, with which the tin ores are locally associated. The larger veins, and the Cajalco in particular, are very irregular in size, sometimes appearing to be mere bunches in the granite. A few hundred feet northeast of the hill the vein has narrowed to six or eight feet, and it is here that the large body of tin was first discovered and the main shafts sunk. A slide prepared from one of the smaller veins, which in the hand specimen appeared to consist wholly of tourmaline, showed bunches of tourmaline crystals radially arranged and imbedded in interlocking quartz grains.

T. Wayland Vaughan has a paper on the outlying areas of the Comanche Series in Oklahoma and Kansas, in which he describes numerous localities in the region indicated, and supports Mr. Hill's conclusion in regard to the Cretaceous age of the deposits. He concludes that the supposed 'Jurassic' of Marcou "has been proven not only not Jurassic, but that it belongs to Cretaceous beds above his so-called *Neocomian*, which is far above the base of the American Cretaceous."

W. G. Mixter has an extended article on electrosynthesis, or chemical union, affected by means of electricity, but not, as distinguished here, that brought about by the heat of the electrical discharge. The special apparatus employed is described, and the eudiometric observations made with a mixture of hydrogen and oxygen, of carbonic oxide and oxygen, methane and oxygen, ethylene and oxygen, acetylene and oxygen. A comparison is made in several cases between the number of molecules oxidized and those of oxygen consumed, and it is concluded that the same electrical current causes the oxidation of a different number of molecules of the gases, the variation being as one to two, while the oxygen consumed varies as one to seven molecules. In conclusion the author regards the molecular change involved in electrosynthesis "to be analogous to those occurring in synthesis effected by heat or light where combination takes place at a temperature far below that at which the gaseous molecules dissociate." W. Lindgren describes monazite from the gold-bearing gravels near Idaho City, in Idaho, where its occurrence is analogous to that observed at other points, as in the eastern United States, Brazil, the Ural Mountains, etc. It doubtless forms an original constituent of the granite of the Idaho basin.

SOCIETIES AND ACADEMIES.

THE NEW YORK ACADEMY OF SCIENCES.

THE last meeting of the Academy until October took place in the lecture room of the Department of Physics, Columbia University, June 7th. Professor William Hallock described 'A New Method for Projecting Views of the Moon.' A hemisphere about 6 or 8 feet in diameter had been prepared and had been whitened. Using this for a screen, Dr. Hallock projected upon it views of the moon with a powerful arc-light lantern, adjusting the distances so that they just fitted the spherical surface. The natural features of the moon were reproduced with extraordinary vividness and lost all the flattening that is unavoidable with plane surfaces. The only drawback is the lack of sharp focus on the edges of lunar photographs. Adopting a suggestion of Professor Rood, Dr. Hallock had gone off at one side of his spherical screen, while a view of the moon was projected upon it, and had photographed it, thus securing a view of half the lunar surface, as if it had been taken at a point in space at right angles to the line connecting the moon and the earth. It gave a fairly true picture of one quarter of the moon from this point of view. Professor Rood had also suggested the value of projecting photographs of diversified topography of the earth on suitably inclined screens, with the object of reproducing their true relations in space, so as to aid topographic mapping. Such projections when viewed from above would give a bird's-eye view of a landscape in its true relations. Dr. Hallock will communicate a full account of these devices to an early issue of SCIENCE.

Miss F. R. M. Hitchcock next presented a

paper on the atomic weight of tungsten, which will appear in the Transactions of the Academy. The tungstic trioxide was prepared from sodium tungstate and gave no traces of silica, niobic or tantalic oxides, iron or manganese, the alkalies or alkaline earths, or molybdenum. The acid was transformed to ammonium salts. By fractionating these, the following atomic weights were obtained, quantities of from 1.5 to 5 grams being used. The different series had been subjected to a different, previous preparation.

	Series A.	Series B.
1st Fraction	182.34	182.34
2d "	182.77	174.63
3d "	179.92	181.87
4th "	183.45	181.79
4a "		174.87
5th "		177.87
5a "		176.79

Another portion of the trioxide, fractionated by a different method, gave on successive reductions and oxidations of the same portion the following series, in which it will be noted that the weights increase with the oxidations and diminish with the reductions:

	Reduction.	Oxidation.
At. W't.	182.68	184.65
	177.25	185.26
	174.00	191.61

The results of fifty determinations gave atomic weights ranging between 154.064 and 191.61. A series of experiments, that were only briefly referred to, established the fact that in all preparations of WO_3 nitrogen was present, even after repeated reduction. Miss Hitchcock was led to conclude that as regards volatility, metallic tungsten is more volatile than the oxide. Wolframite was found to contain both hydrogen and nitrogen, and scheelite has large quantities of nitrogen.

J. F. Kemp,
Secretary.

ZOOLOGICAL CLUB, UNIVERSITY OF CHICAGO, MEETING MAY 19.—ABSTRACTS OF PAPERS PRESENTED.—ORIGIN OF THE PRONEPHRIC DUCT IN SELACHIANS.

There have been different opinions as to the origin of the Pronephric Duct in Selachians. Acanthias embryos were used in making a renewed study of the subject. The Anlage of the Pronephros consists of segmental outgrowths of the somatic layer of the somites from the seventh to the twelfth segments. These are connected with the ectoderm at their outer edge. This fusion early disappears. The tip of the distally growing duct was constantly fused with the ectoderm. One case of Karyokinesis between ectoderm and duct was found. Growth also takes place throughout the length of the duct. Frontal sections showed six Pronephric tubules on the right side with aortic diverticula between. Connected with the aorta there were also found structures which may be interpreted as glomi.

From the facts here given we conclude that the earliest Anlage of the Pronephros fuses temporarily with the ectoderm and may possibly receive some few cells from it. The first part of the duct proper seems to share to some slight degree in the mesodermal origin of the anterior region. So far as the duct develops distally the connection of its tip with the ectoderm is maintained. This fusion would be sufficient evidence of a genetic relation for those who accept the principle of the teloblastic growth of organs. On the appearance of the paper by Rabl the preparations were again examined carefully, but without finding any grounds for abandoning the view that there is a genetic connection between the duct and the ectoderm in Selachians.

Emily Ray Gregory.

Dr. Whitman followed with a paper on 'The Development of the Wing-bars in Pigeons.'

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On the Origin of the European Fauna. R. F. Scharff. Dublin University Press. 1897. Pp. 427–514.

Some Observations of a Foster Parent. John Charles Tarver. Westminster, Archibald Constable & Co., 1897; New York, The Macmillan Co., 1897. Pp. x + 282. $1.75.

Electro-métallurgie. Ad Minet. Paris, Gauthier-Villars et fils. 1897. Pp. 195.

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